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PROJECTIONIST

JANUARY • 1959

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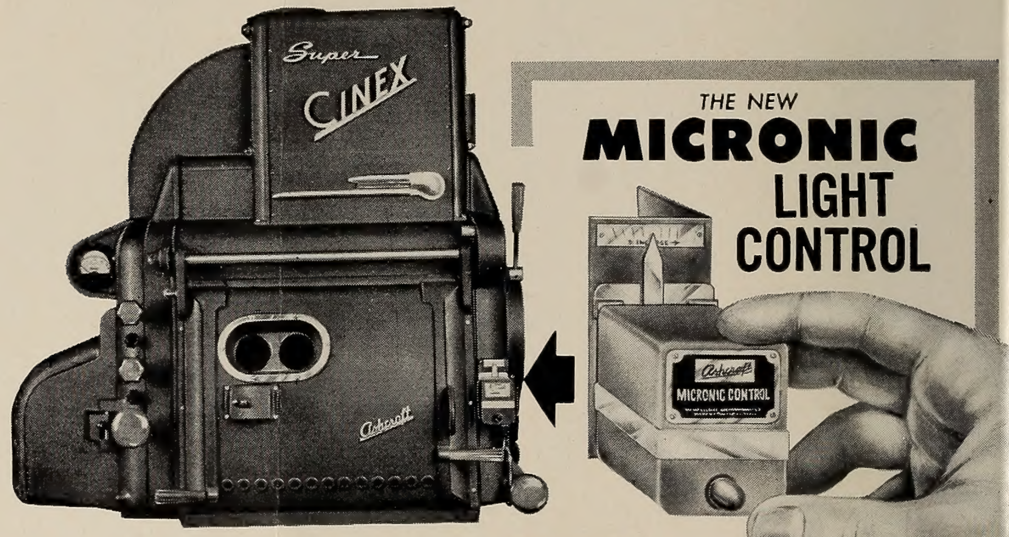

At last a truly precision light control has been developed. It does not employ cycling thermostats but a light beam moving five times faster than the light source itself. The MICRONIC CONTROL maintains the correct crater position within a few thousands of an inch continuously, while maintaining an exact arc gap.
Forty years of experience have been condensed into the design of the MICRONIC CONTROL—the ultimate in precision light and screen color control whereby screen illumination is always maintained at a maximum light and distribution level.

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International PROJECTIONIST

R. A. ENTRACHT, *Publisher*

JAMES J. FINN, *Editor*

R. A. MITCHELL, *Contributing Editor*

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Monthly Chat

That Old Devil Toll-TV Again

NOT long ago, last March to be exact, this corner expressed wonderment at the opposition of organized labor to pay-TV. We cited the testimony of David Sarnoff, board chairman of RCA, before a Congressional committee to the effect that toll-TV would kill what he described as "free" TV. With this view IP is wholly in agreement—and even more—our notion being that pay-TV would not only kill "free" TV but also toll-TV.

This is the reason why IP, practically alone among those who are interested in the welfare of the organized crafts—including the talent and technical production forces—could never and does not now "buy" the argument against toll-TV. Its reluctance to accept the argument advanced is based not alone upon the nauseating technique employed in presenting old movies on pay-TV but rather on the simple fact that the imposition of a charge for viewing the large slices of tripe offered on TV today, and not alone the old movies shown, would quickly chase people out of their homes in search of other entertainment.

This opinion was buttressed by an item which appeared in "Film Daily," esteemed newspaper of filmdom. We quote from an informative column therein conducted by Phil M. Daly:

> "Speaking of TV, Phil M. the other day found one large theatre operator who is very much *in favor* of toll-TV. The gentleman, in fact, said he wished *all* TV was on a fee basis. 'The quickest way to eliminate TV as a serious theatre competitor is to introduce the admission charge,' he argued. 'That would shrink the sale of sets and the sets now in homes would be turned off far more than they would be turned on,' the circuit man added."

IP wishes to add to the foregoing statement a fervent "Amen".

Industry's Will for Self-Destruction

WHAT A PITY it is that the Motion Picture Research Council has terminated its traveling field staff which for the past two years has done excellent work in the interest of efficient and mutually beneficial interchange of information between the production and theatre branches of the industry. During this period the field staff, all highly competent technicians, visited more than 700 first- and second-run theatres in 100-odd cities, applying rigid tests to visual and aural projection units and offering recommendations for improvement to exhibitors.

That such a service was sorely needed and constituted a boon to exhibitors is indicated by a list of only the *chief* deficiencies exposed: focus, screen brightness levels, focal length of lenses, screen masking, print damage, and drive-in theatre optical standards.

Council President Dr. William F. Kelly stated that there will be "continuing studies of theatre problems"; but it is obvious to practically everybody in the field that even with the best will in the world these "studies" will fade away almost to the vanishing point. "The cost," said Dr. Kelly, "can no longer be borne by the producers alone."

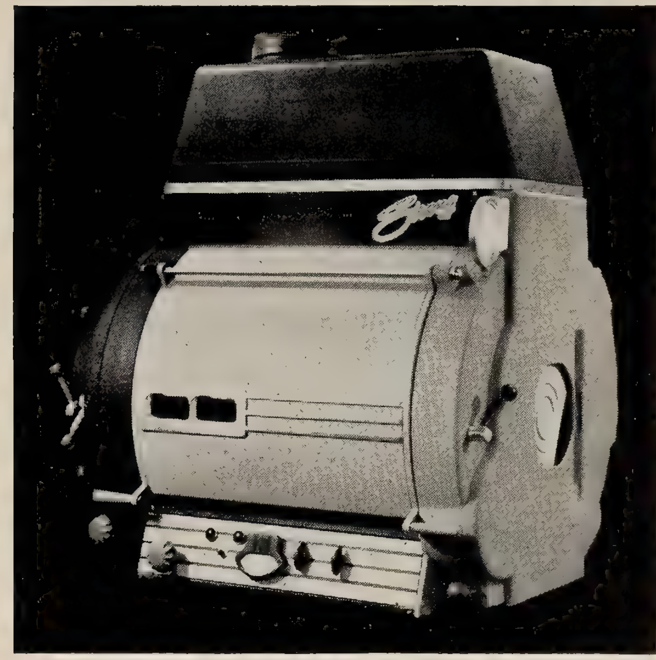
Mark well these mournful words from an industry which now charges an admission price of from one to three dollars for a single picture—and for which a single "star" gets as much as $750,000!

ONLY ONE PROJECTION LAMP

of many models and types is ideal for you

Strong manufactures the only complete line . . . lamps with many exclusive features. We will, without obligation to buy, demonstrate in your theatre the ones best for YOU.

Strong's Exclusive Lightronic System automatically maintains the correct arc gap length and the position of the positive crater at the EXACT focal point of the reflector. Evenly distributed screen light of constant intensity, and unchanging color is maintained without manual adjustments.



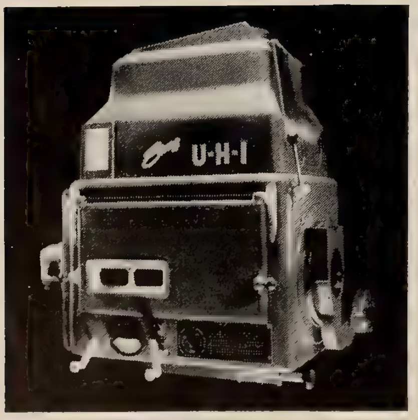
THE JETARC — *Most Powerful Projection Arc Lamps Ever!*

Proved throughout America against all makes of lamps. Employs a totally different system—a three dimensional, cylindrically shaped light source. Delivers up to 65,000 lumens with wide apertures—double the light of any 16½″ reflector lamp and 51% more light than any lamp using an f 1.7/f 1.8 lens.

Projects all film widths by any process without changing the mirror. 21-inch cold type reflector—the largest ever employed—is an integral part of the rear door. Aperture spot size is changed by a convenient control of the position of the main reflector. The burner position need never be changed.

A 10 mm x 25″ non-rotating Ultrex positive and rotating 7/16″ x 12″ solid Graphite negative burn at 140 to 160 amperes and 70 to 78 volts. A 10 mm x 25″ Hitex positive may be burned at 125 to 140 amperes.

Brings indoor theatre quality projection to the largest drive-in screens.



U-H-I

Exclusive Beam Shaper Lens on 13.6 mm Trim Lamp Patterns the Normally Round Spot to the Size and Shape of the Aperture so as to Efficiently Utilize all Useful Light.

Burning a 13.6 mm carbon trim, the optical speed is equivalent to f 1.5 with f 1.5/1.6 lenses and projectors cleared for f 1.5. Light loss due to shadowing by feed mechanism is minimized. Exclusive built-in exhaust system permits use of the "cold" reflectors. 50% of the heat energy passes through the mirror instead of being reflected to the aperture. Separate Bodine gear head motors with self-enclosed gear reduction for each carbon drive. Another exclusive.

SUPER "135"

Burns a choice of four carbon trims, 10 mm Hitex carbons at 135 amperes, 9, 10 or 11 mm regular carbons at 120 amperes. 18″ f 1.7 or 16″ f 1.9 reflector.

The Super "135" and U-H-I accommodate a 20-inch carbon trim. Five exclusive features: (1) Arc stabilization by its own magnetic field (no magnets required) and air jet which also prevents deposit of soot on the air-cooled mirror. (2) Mirror is integrated with rear lamphouse door which swings completely out of the way to facilitate retrimming and permit easy cleaning of the reflector and lamphouse. (3) The entire burner assembly can be shifted for easy spot focusing without disturbing the relative carbon positions or arc equilibrium. (4) Single control eliminates guesswork in matching the speeds of the two carbon feeds. (5) Unitized component design permits quick attainment of correct light for any projection technique. Single control amperage selection.

— *Write for literature* —

THE STRONG ELECTRIC CORPORATION 31 CITY PARK AVENUE • TOLEDO 1, OHIO

INTERNATIONAL PROJECTIONIST

Volume 34 JANUARY 1959 Number 1

New Insights Into the Carbon Arc

By ROBERT A. MITCHELL

We who have been interested in and actually operated the carbon arc for more than 30 years are here given a new insight into that which actually happens to produce a light source which, of all other illuminants available today, rivals the power of the sun.

THE CARBON ARC is a "gaseous discharge" between combustible electrodes which are exposed to the air and to various magnetic influences. The unique character of the arc makes it extremely sensitive to the current and pressure factors of the electric power supplied to it.

Fortunately for the projectionist, the projector carbons manufactured today are high-quality products capable of giving excellent results when burned under the recommended conditions. Not only is a good arclamp needed—one capable of feeding the carbons at a proper rate and maintaining constant positive-crater positioning—but also a rectifier or motor-generator set specifically designed for the type and size of arc it is to energize.

The importance of correct volt-ampere characteristics of the power supply cannot be overestimated. Unlike an incandescent light bulb or other appliance having a nearly constant electrical resistance, the resistance of a carbon arc decreases as the current (amperes) increases. This is, of course, the effect of heat, which increases the conductivity of the arc stream and the layer of gas which covers the positive crater like a thin film.

Unless the power supply has current-limiting characteristics, a carbon arc becomes a virtual short-circuit. As the current increases, the resistance of the arc decreases to permit a further increase of current, and a condition of instability is quickly reached. The carbons become overloaded, and the arc sputters violently because the lip of the positive crater is burned away.

If the power supply be a generator, too great a drain of current usually causes the machine to stop generating altogether. The windings may overheat and burn the insulation, necessitating costly repairs.

Temperature of Arc Stream

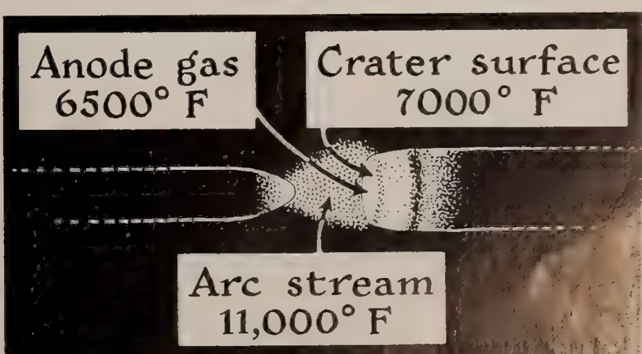
An unstable arc always gives a flickering light; and an overloaded high-intensity trim of carbons fails to produce the desired H-I effect. When the lip of the crater burns away, the luminescent substances emitted by the positive core are lost in the tail-flame. Low-intensity carbons spindle when overloaded.

Arclamp carbons are essentially pure carbon rods containing special materials in a central core. Carbons intended for use in simplified H-I ("Suprex") lamps are copper-plated for better current conduction. The arc is "struck" in every type of lamp by bringing the ends of the two carbons together and quickly separating them by a distance of 3/8 to 1/2 inch—the "arc gap."

D. C. Arc Light Emission

This procedure permits current to flow and produces a hot spark which volatilizes some of the carbon to provide the current-conducting arc stream of carbon gas and hot air. Most of the light emitted by a direct-current arc emanates from the crater, or cup-like depression, formed in the end of the positive carbon.

The electrons which constitute the electric current always flow from the negative carbon to the positive through the hot conductive gases of the arc stream. The electrons are invisible,



Fahrenheit temperatures in the various regions of the carbon arc output.

NOTE: Reprints of this article are available at a nominal cost. Minimum order quantity: 100.

and accordingly produce light and other forms of radiation only by their effect upon the matter which they encounter. During their passage from the tip of one carbon to the tip of the other, impelled by the positive charge of the positive carbon, the electrons encounter various regions of electrical resistance where friction turns some of the energy of their flow into heat and visible radiation.

The pointed tip of the negative carbon is heated by the resistance which the electrons meet as they pass from the highly conductive solid carbon to the less conductive gases of the arc stream. The arc stream, itself, has a very high temperature (6000° C = 11,000° F) because of frequent collisions of electrons with gas atoms. Only a small percentage of the electrons smash into the gas atoms "head on," however, and the total amount of heat in the arc stream (calories) is less than the amount of heat generated in the positive crater.

Crater "Anode Layer"

The anatomy of the positive crater, even in the case of a low-intensity arc, is rather complex. If the electrons passed directly from the arc stream to the more conductive positive carbon, it would be difficult to understand how the crater could get so hot.

Once arrived in the positive crater, the bullet-like electrons encounter a dense, relatively cool (3600° C = 6500° F) film of carbon gas that offers considerable resistance to their passage. This gaseous skin is called the *anode layer*, an "anode" being a positively-charged electrode. (A negatively-charged electrode is a "cathode.") The electrons are slowed down by friction; and the energy which they lose is absorbed by the anode layer and turned into heat.

It may seem strange that the anode layer should be cooler than the crater floor and arc stream, but such is the case. The anode layer has a relatively low heat-retaining capacity, so it transfers the heat generated by the electrons to its surroundings, especially to the solid crater floor which it covers like a thin atmosphere. The solid carbon then gets hotter and hotter until it attains a temperature of 3900° C = 7000° F at the surface of the crater floor.*

At this high temperature solid carbon readily "sublimes," or turns into gas without first melting to a liquid. Many substances, such as naphthalene moth balls and camphor, sublime even at room temperature! Now, the vaporized carbon passes into the anode layer where it transfers electron-generated heat to the crater floor. It then evaporates into the tail-flame of the arc and cools the remaining anode gases as it does so.

The heated carbon vapor of the tail-flame burns to carbon-dioxide gas the moment it comes in contact with the oxygen of the air, but the heat of this combustion is very small compared to the heat of the arc itself.

The anode layer of dense carbon gas may be considered as a sort of heat-transferring mechanism which turns the kinetic energy of electrons into heat and then transfers the heat energy to the solid positive carbon. The crater thereby becomes hot enough to radiate a white light which is bright enough to make possible the projection of motion pictures on large theatre screens.

Principle of H-I Arc

The Beck, or H-I, arc works on the same basic principle as a L-I arc. Contrary to popular opinion, the temperatures prevailing in a H-I arc are no higher than those in a L-I arc. The only difference is the addition to the core of the H-I positive carbon special light-producing ingredients which form an intensely brilliant ball-like flame emitting approximately three times more light than the white-hot crater of solid carbon! This remarkable light-producing core material consists of compressed powdered carbon with which rare-earth compounds* are mixed.

Remember the old-fashioned Welsbach gas mantles used for household illumination many years ago? A bare gas flame gives out very little light despite its high temperature. (Unlike hot solids, hot gases are poor radiators of light.) The bare gas flame is analogous to a L-I arc. But when a mantle is placed in the flame, the rare-earth compounds with which it has been impregnated are excited by heat into brilliant luminescense. Somewhat the same process takes place in the "white-flame" and H-I arcs.

The chief electrical peculiarity of the H-I arc is the effect of the luminescent rare-earth atoms on the resistance of the relatively cool anode layer of carbon gas which, as we have seen, plays a very important part in the burning of any carbon arc. In fact, without the electrical resistance of the anode layer, the electrons would pass from the arc stream into the highly conductive positive carbon without changing much of the electron-energy into heat and light.

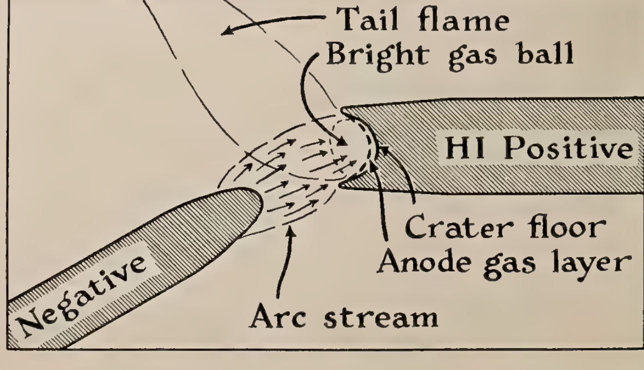
H-I Current Requirements

Rare-earth atoms are fairly good conductors of electricity when excited by high temperatures. The resistance of the anode layer is accordingly lowered and the transfer of energy less efficient than in the L-I arc using plain carbons. To maintain a fair amount of voltage-drop in the anode layer of the H-I arc, therefore, the voltage of a

* The positive crater of a carbon arc is not as hot as the surface of the sun, as has sometimes been stated. The sun's surface temperature is 6000°C = 11,000° F and has a "color temperature" matched by the less hot H-I arc.

* The rare earths comprise a group of 15 iron-gray metals having similar physical and chemical properties. Cerium and lanthanum are the most abundant. Thorium and such rarer aluminum-like metals as scandium and yttrium are associated with the rare earths. You very likely have some rare-earth metals in your pocket. Cigarette-lighter flints are rare-earth alloys.

Delineating the anatomy of a high-intensity carbon arc.



H-I arc is low and the current (amps.) high in comparison with the voltage and current of a normal L-I arc consuming the same amount of power (watts).

Nearly all L-I carbon trims require about 55 volts for satisfactory operation. A 1650-watt L-I arc thus consumes a current of 30 amperes. A "Suprex" H-I arc, on the other hand, requires only about 37 volts for approximately the same amount of power consumption (1665 watts) in its less resistive anode layer, hence the need for a current of 45 amperes. (Watts = Volts × Amperes.)

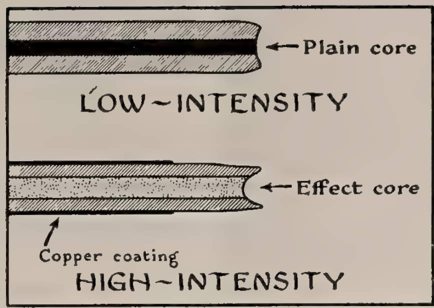
"Compression" of Gas Ball

The success of the ordinary H-I arc as a projection illuminant depends upon the compression of the heat-excited rare-earth atoms in the positive crater, which is deeper than the relatively flat L-I crater on account of the greater current density. By confining the flaming materials to the crater instead of allowing them to escape at once in the tail-flame, a bright luminescent ball is formed which is responsible for about 75% of the total light of the H-I crater (the remaining 25% coming from white-hot carbon, as in a L-I arc).

Compression of the flaming materials is accomplished by the influence of a carefully adjusted magnetic field. Such a field appears to act upon the luminescent gases like a continuous draft of air, pushing them into the cup-like crater. The desired magnetic field is supplied by the current flowing through the carbons in lamps employing angular trims, or by a magnet placed behind the lamp mirror when the carbons lie on the same line (coaxial trim).

Small auxiliary magnets are sometimes placed beneath the arc in both types of lamp to assist the main magnetic field for more efficient burning. The action of the magnetic fields can be seen in the tail-flame, which assumes a definite direction when the arc is burning as the lamp manufacturer intended.

Directed drafts of air may also be used to shape and control the flame of luminescent rare-earth atoms in the H-I arc gases. The Gretner Ventarc, commercially available as the Strong Jetarc and the National Ventarc, attains extremely high light levels by constricting the luminescent gases *via* air jets concentrically arranged around



The plain core of a L-I positive carbon consists mainly of compressed powdered carbon to center the luminous crater and prevent arc "wandering." Small amounts of potassium salts are also present to assist in the formation of a conductive arc stream.

The "effect" core of a high-intensity positive contains, in addition to soft carbon, rare-earth compounds which produce a brilliant white flame or luminescent ball in the crater. Carbons for use in simplified lamps are copper-plated for less resistance to the electric current.

the positive burner and directed toward the end of the positive carbon. Compression of the arc results in increased brightness, and the cylindrical form of the light source permits the use of an auxiliary spherical mirror facing the large elliptical mirror for increased screen light.

Ballast Requirements

As stated earlier, the carbon arc is very sensitive to the volt-ampere characteristics of the current supplied to it, and will quickly "run wild" unless the available amount of current is limited in some way. This is because increased current decreases the resistance of a carbon arc and permits still more current to flow. The power supply must "dole out" the amperes very gingerly, cutting down on the supply every time the arc tends to "sneak" a few extra amperes. An overloaded arc is an unstable, flickering arc which the automatic carbon-feeding mechanism cannot regulate satisfactorily.

The conventional multiple-arc generator is designed to supply more and more current as the electrical load increases. This is why such a generator can supply two arcs burning at the same time during changeovers. When the second arc is struck, the first arc, already burning and sending light to the screen, is not disturbed in the least—it continues to be supplied with adequate current at normal voltage.

But this same valuable characteristic of the multiple-arc generator makes it impossible to obtain satisfactory arc operation by connecting the arc *directly* to the generator terminals! The arc would run wild, the generator would become overloaded, and the resulting large counter-electromotive force in the armature windings would demagnetize the generator and stop the production or current.

A current-limiting device—the ballast rheostat—is needed when a multiple-arc generator is used. There must be one ballast resistance for each arc, and each ballast is connected *in series* with the arc it regulates. And current-regulation by a ballast rheostat is automatic!

As more current flows through the arc, more must necessarily flow through the ballast, inasmuch as the number of amperes flowing is the same in all parts of a simple series circuit. The greater the current flowing through the ballast, the greater its voltage drop, for its ohmic resistance, unlike that of an arc, is practically constant. The result is a decrease in arc current and a return to normal burning.

The ballast rheostat functions continuously, of course, so instead of periodic "up's and down's" in arc current, normal steady current flows through the circuit at all times. It is necessary, however, to employ an amount of ballast resistance (ohms) greater than a certain minimum value in each case to avoid unstable arc burning.

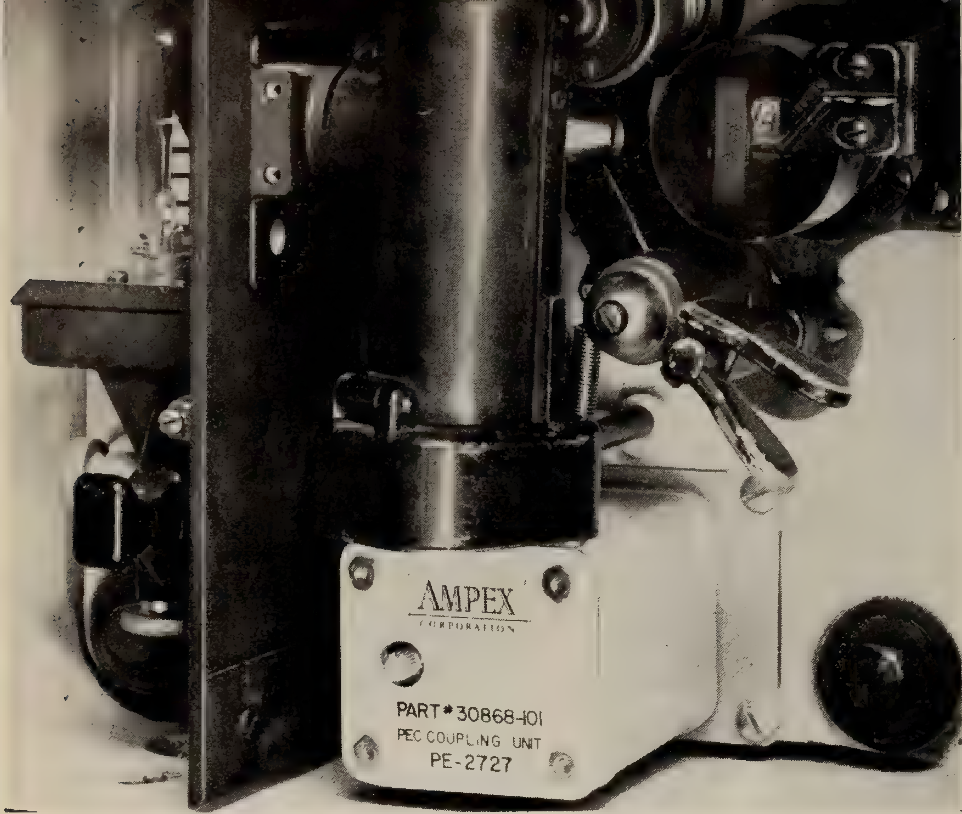
Low-intensity arcs having a voltage-drop (arc-drop) of 55 or 60 volts require 80-volt generators and the absorption of 20—25 volts by the ballast. A ballast resistance of from 0.6 to 0.9 ohm is normal. Simplified H-I ("Suprex") arcs rated at 35—45 volts require 50- or 60-volt generators and the absorption of at least 15 volts by the ballast. This amounts to a ballast resistance of 0.2—0.4 ohm.

H-I arcs of higher power have the same requirements as L-I arcs, that is, a 20- or 25-volt ballast drop and correspondingly higher generator output voltages. Remember the rule: Gen. volts = Arc volts + Ballast drop.

Rectifiers More Economical

The resistance of the DC power lines from the generator to the projector lamps should be considered as part of the ballast resistance: however, the voltage-drop occasioned by the transmission lines is ordinarily so very small that it may be disregarded. As an example, a 100-foot length of B & S no 0 copper wire has a total resistance

(*Continued on Page* 21)



Ampex Photoelectric Cell Coupling Unit, shown mounted in a typical optical reproducer, converts the output of a photoelectric cell to coincide with the electrical characteristic of a magnetic head so that the signal can be played through the magnetic sound system.

Ampex Mag-Optical Converter for Theatre Sound Systems

This converter enables an optical sound track to be played through the magnetic sound system, thus providing an economical and convenient means of up-dating optical sound to a quality consistent with modern standards, reducing operating and maintenance procedures, and clearing the projection room of excess equipment. Now available for general distribution.

IT HAS long been axiomatic in the professional motion picture field that the term "conversion" could readily be substituted for the term "correction," so myriad have been the processes, procedures and equipment units introduced under one trade name or another. It remained for Ampex Corp., manufacturer of magnetic tape recorders and custom-made theatre sound equipment, to dispel—indeed, banish—this concept.

The Mag-Optical Principle

Ampex has developed and most successfully proven the worth of a unit sorely needed and eagerly sought after by the theatre field for the past five years—a simple and inexpensive converter assembly which will enable the playing of optical sound tracks through the magnetic sound system.

This Magoptical Converter has been field-proven over the past year in representative installations such as Ampex Todd-AO sound locations, at the 20th Century-Fox preview rooms, and in many U.S. Armed Forces theatres throughout the world.

Dual Purpose Easily Achieved

Use of the Magoptical Converter will result in the magnetic sound system handling *both* magnetic and optical sound, thus making unnecessary the maintenance of *two* systems. More efficient operation is possible in that only one set of controls and emergency facilities is utilized. Selection of the appropriate type of sound is simple and instantaneous at individual projectors, so that one projector can be running an optical track while the other is set up for stereophonic operation.

The two main components of the assembly are the photoelectric cell coupling units and preselect units. One of each is required for every projector in the system. Also furnished is a non-sync matching transformer which

Ampex Preselect Unit provides the projectionist with instant selection of the appropriate type of sound. It is mounted on the magnetic reproduce penthouse at each projector.

provides a balanced line condition from any non-sync source. Mounting brackets and interconnecting wiring complete the assembly.

Mounted in the optical reproducer, the photoelectric cell coupling unit receives the signal from the photoelectric cell and converts it to conform to the electrical characteristics of a magnetic head. The signal can then be played through a conventional magnetic sound system. The unit is small in size and is shipped with three different types of brackets, which provide mounting facilities for this component in any of the more popular optical reproducers.

A potentiometer permits adjustment of the photoelectric cell polarizing voltage to permit balancing optical sound level between projectors, thus the level balance of the magnetic system need not be disturbed. Terminals on the face of the unit may be strapped to obtain three optional curves at both the low and high ends of the response spectrum to achieve the proper roll-off for the particular auditorium. A selection of output terminals allows three different output levels to be utilized: zero db, –6 db, or +6 db.

Automatic Channel Selection

The preselect unit is mounted on the magnetic reproducer penthouse. It provides instant selection of the appropriate type of sound (four-track magnetic, optical, or non-sync) at each projector. It automatically connects the signal to the correct channels and terminates unused channels in a resistive load. Level adjustments are furnished for each sound track, so that balancing between projectors and channels is easily accomplished.

The unit is shipped with a 50-foot captive cable installed, threaded

Modern Projector Efficiency

Projectors such as the Brenkert BX-40, BX-60, and BX-80, and the new Century models H and HH employ *large-size* stars and cams for the highest possible degree of image steadiness and long life. The Century and Brenkert projectors furnish the best answer to European critics of the small star-and-cam size of most American mechanisms!

To mount these or other fine mechanisms on Western Electric universal bases or the somewhat similar Motiograph H bases is sheer folly—yet, it is being done every day. Likewise, the use of old-style Simplex pedestals with heavy modern arclamps is simply stupid. Lamps were much smaller in the days of the Simplex Regular and Super mechanisms. The light-weight columnar pedestals were adequate 20 years ago, but they fail to meet the exacting requirements of high-powered wide-screen projection.

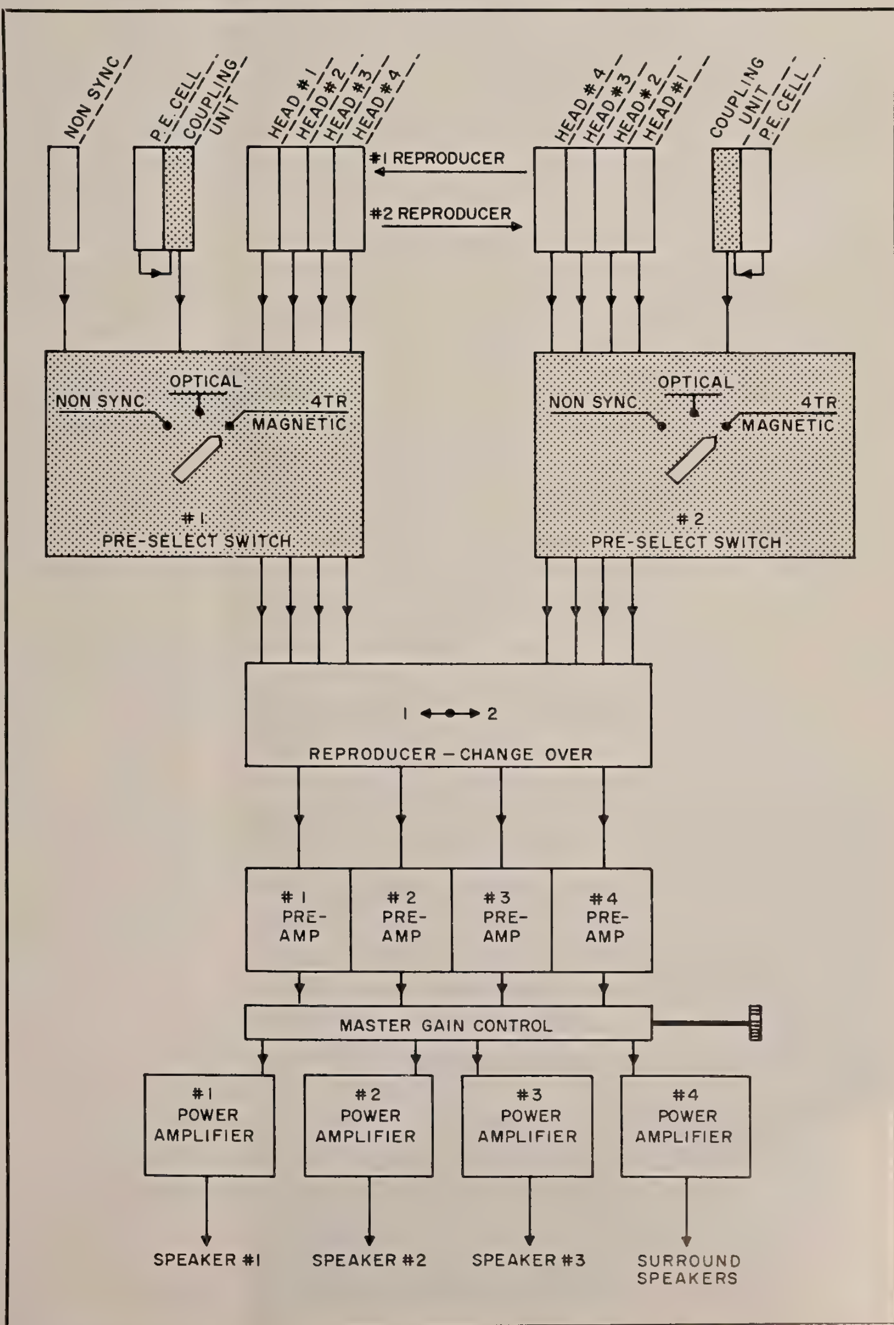
Not all machine-vibration problems are solved by sturdy bases, however. Rigid, well-balanced supports we must have; but not even the sturdiest of them can completely overcome the effects of dynamically-unbalanced fly-wheels, bent shafts, lop-sided shutters, motor armatures, and drive couplings. Rapid vibration of a projector, when it shows up on the screen, may either blur the finer pictorial detail of the image or cause the picture to dance or tremble.

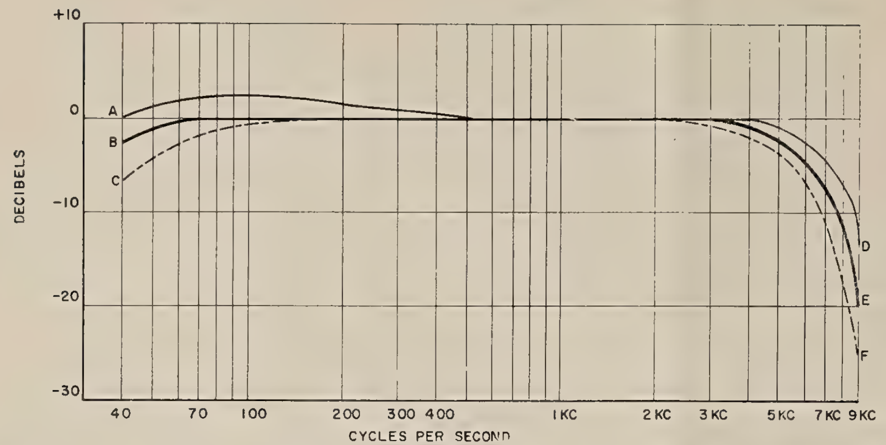
Lenses, intermittent movements, and even the prints have been blamed for projection defects which were ultimately traced to machine vibration!

Telephone Diagnosis of heart ailments are a possibility with new, 5-lb. transistorized unit which transmits heart sounds and electrocardiograph signals *via* phone—without any patient-to-phone connections. Developers at U. of Kansas Medical Center say device should solve most problems of phone consultations between heart specialists.

Patient, with transmitter attached sits next to phone mouthpiece.

This simplified functional block diagram illustrates how the Magoptical Converter is installed in a typical theater sound system. Components of the converter assembly are shaded.





These curves indicate the frequency response obtained from optical sound tracks through the Magoptical Converter. Note the three optional curves at both the low and high ends. The unit is shipped from the factory strapped for curve B-E.

through a conduit nut, for connection to preamplifier input circuits. Ampex magnetic heads simply plug in a receptacle on the unit, while other heads may be connected to an internal terminal board.

Most magnetic sound systems employ balanced line inputs to the preamplifiers, and if the non-sync input were unbalanced a mismatch would occur. The non-sync matching transformer obviates special operating procedures by ensuring that the non-sync source always presents a balanced line condition.

Definite Updating Achieved

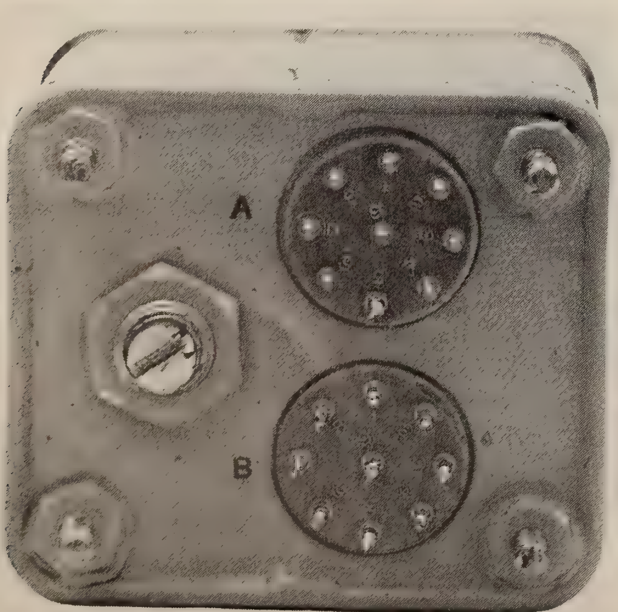
Ampex is convinced that the Magoptical Converter presents theatres with a convenient and inexpensive means of updating optical sound to a quality consistent with modern standards, simplifying operating and maintenance procedures, and clearing the projection room of excess equipment. "Too often modern magnetic sound systems are standing idle while older optical systems — some grossly inadequate when compared with SMPTE recommendations—are operating," states Al Lewis, Ampex supervisor of theater sales.

Kit-Form Now Available

While the converter is now being offered in kit form for the first time, it has always been an integral part of the Ampex Todd-AO custom sound systems. Probably the most grueling test of the equipment has been at the Egyptian Theatre in Hollywood, where chief projectionist Earl Bower has changed sound operation from six-track magnetic to four-track magnetic, then to optical, and back to six-track magnetic. All these types of sound tracks were played through the one magnetic system, with outstanding results reported.

Mr. Lewis concludes: "We of Ampex feel that the Magoptical Converter is a long overdue step toward a simplification of operating procedure while effecting an actual saving in maintenance and replacement expenditures. It is an easily-installed device with no suspension of normal schedules necessary. We are sure that it will prove a valuable contribution to the theatre field."

[NOTE: A profusely-illustrated brochure setting forth complete details of this Converter is available without charge from E. M. Lewis, Ampex Corp., 934 Charter St., Redwood City, Calif.]



Two terminal boards on the face of the p.e.c. coupling unit provide strapping facilities to achieve optional rolloff at both the low and high ends of the frequency response curves, and to vary basic output levels. The screwdriver adjustment allows sound-level balance between projectors.

BOOK REVIEW

Fundamentals of transistors (2nd Edition), by Leonard Krugman. Published by John Rider, Inc., 116 West 14th St., N. Y. City 11. Page size 5½ x 8½ inches, soft cover, 176 pages. Price: $3.50.

In 10 years the transistor has grown from an interesting infant to a lusty adolescent already earning its keep. Keeping pace with the rapid advance in semi-conductor technology is this second edition of a 1954 text which became internationally-known. The author rewrote numerous portions of the original text and added a good deal of new material which updates the book to the level of modern transistor art.

Review Questions a Feature

This new edition deals with the theory, construction and operation of most significant semi-conductor devices such as surface barrier, intrinsic, drift, avalanche and spacistor types. Illustrative circuits and design theory applicable to amplifiers, oscillators and high-frequency applications reflect the present state of the art. Review questions emphasizing major topics have been added at the end of each chapter.

The author retains all the salient features of the first edition, especially the use of practical numerical examples which illustrate the formulas and equations. Illustrations are ample—clear and easily readable. An excellent introduction to semi-conductors for the practice design engineer, the student, the laboratory technician, and all others who desire more than just elementary treatment of the subject.—J.J.F.

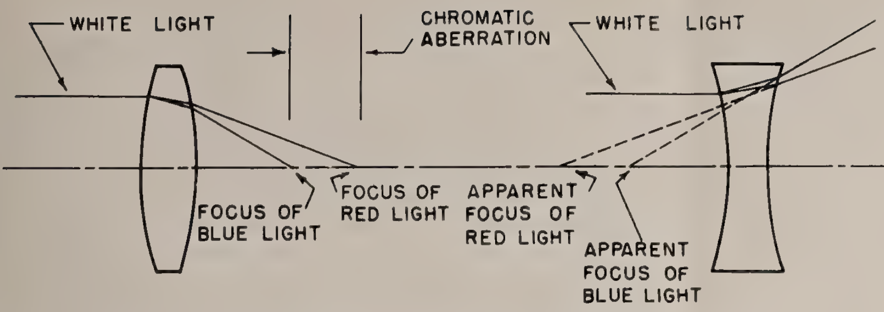


FIGURE 1. Example of simple negative and positive lens

Devious Ways of Light and Lenses

By H. E. ROSENBERGER

Scientific Bureau, Bausch & Lomb Optical Company

QUESTION: Certain statements in the article "Index of Refraction" which I reread in IP recently intrigue me, notably that stating "such a medium as glass must have one refractive index for *each* wavelength of light."

Now, then, since red is a longer wavelength and travels faster through glass than does blue light, how is it that when we project color pictures we get a comparable color conformation on the screen as has the original print?

BERTRAND S. WEBSTER

Appended is a brief but inclusive explanation of how this basic problem was overcome through intensive research and applied science.

BECAUSE the index of refraction of glass varies with the wavelength (color) of light, a simple lens bends the different colors by different amounts, as is shown by the simple positive and negative lens illustrated in Fig. 1.

The distance between the red and blue foci is called the "longitudinal chromatic aberration" of the lens. This distance depends, in part, upon the power of the particular lens and, in part, upon the so-called "dispersion" of the glass used in the lenses.

The optical industry has developed hundreds of different kinds of optical glasses, some having a very high dispersion, and some having a very low dispersion; while others fall between these two extremes. Unfortunately, it has not been possible to produce glasses with zero dispersion.

Negative vs. Positive . . .

The optical designer, however, has found ways to overcome this difficulty. It will be observed in Fig. 1 that the positive lens brings the red light too far to the right of the blue; while the negative lens brings the red light too far to the left of the blue.

What happens then? Just this: the lens designer, taking advantage of these physical facts, proceeds in time-honored fashion to play the positive against the negative, as follows:

He selects such combinations of lenses which, by combining a *positive* lens element made from one kind of glass with a less powerful *negative* lens element made from another kind of glass, results in a lens having a *net positive* power—and at the same time insures that the chromatic aberration of the negative element cancels out *exactly* the chromatic aberration of the positive elements (Fig. 2).

Any other questions?—ED.

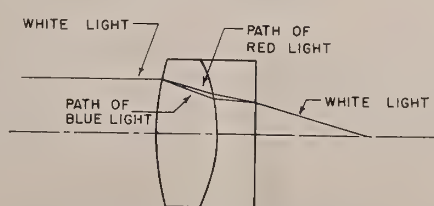


FIGURE 2

Versatility of Film Cited by Kodak Executive

Advantages of motion picture film in the production and presentation of TV programs were discussed by Ed Stifle, of Eastman Kodak, before a recent meeting of the Radio & TV Executives Workshop. Stifle spoke primarily of the capabilities of color film, its characteristics and flexibility for production, and its equipment.

He pointed out that a major advantage of motion-picture equipment is its portability and availability. Film scenes can be shot anywhere in the world, in studios or on location, in contrast with the limitations of bulky TV cameras, coaxial cables, and auxiliary equipment.

Film camera equipment provides good color-matching between scenes, he added, and it also permits animation, along with "live" action, if desired.

Flexibility a Primary Concern

The production flexibility of film is outstanding, Stifle emphasized. A producer can shoot scenes in any sequence, backward or forward, and can speed production and trim costs by using multiple camera crews. He can "freeze" a single frame, stop or reverse action, or introduce optical effects for greater realism and impact, if desired.

Stifle noted, too, the great benefit in having an existing library of film footage available on call. Other advantages of film, such as direct visual inspection of the image and easy editing, plus simple splicing at *any* frame, are sometimes so much taken for granted that their true value to swift, quality production has perhaps been underestimated, Stifle said.

Definition Gives "Tone" Value

Because of the universality of projection equipment, moreover, film can be presented readily over any TV station. Cited was the wide scope of use provided by film for such presentations as sponsor and station previews, regular telecasting, theatre screenings, and program syndication. Film characteristics have been developed and improved so that a wide choice in types of color and black-and-white films is now available. Today's films have adequate sensitivity and provide excellent definition and tone reproduction, said Stifle.

Research and engineering have provided some 16 different films for different kinds of color, and laboratory facilities have expanded so that color is versatile and readily available on a service basis similar to black-and-white.

Significantly, a public relations representative for the tape industry admitted that the full potentialities of the medium could not be realized for at least another three years.

THE PISTOL-PACKERS KNOW WHA

MAYBE they *are* "just kids" but they know what they want when it comes to pictures. And millions of them talk it over weekly, select the best bets and take in a show. In fact, they and their parents constitute living, breathing proof of the time-tested observation . . . *the better the picture, the better the box offi*

So it really does pay to cater to the six-g set—pick the best in story and talent—use t latest, most advanced technics.

That's why close co-operation with the Ea man Technical Service for Motion Picture Fil

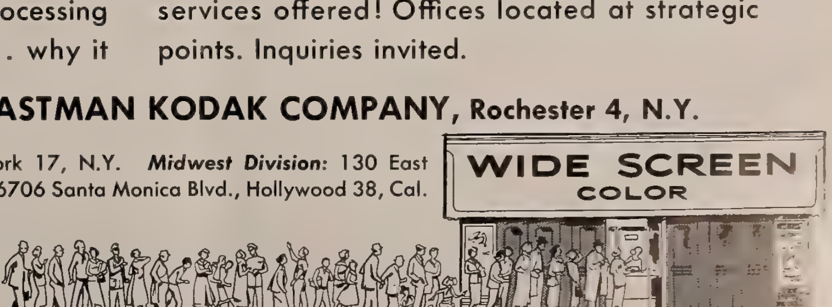
It's what's on the screen...and what people sa

THEY WANT... Just listen to them!

with its long background of experience in every phase of film selection, production, processing and exhibition, can be so helpful . . . why it pays to take full advantage of the many special services offered! Offices located at strategic points. Inquiries invited.

Motion Picture Film Department, **EASTMAN KODAK COMPANY,** Rochester 4, N.Y.

East Coast Division: 342 Madison Ave., New York 17, N.Y. ***Midwest Division:*** 130 East Randolph Dr., Chicago 1, Ill. ***West Coast Division:*** 6706 Santa Monica Blvd., Hollywood 38, Cal.



about it... that counts

A Two-Sided View of Filmstrip Technique

COMMENT: Some critical notes anent our "Notes on Filmstrip Technique" (IP, October, 1958, p. 15) appear on the following page. We welcome this commentary if only on the basis that the world needs not so much to be told as to be reminded. If our comments be provocative, we fulfill our function.

We stated that "some manufacturers offer free replacement of filmstrips which have been damaged in use"—the manufacturer's comment being that the "suitable" word should have been "majority" instead of "some." This difference of opinion anent semantics still brings us back to the *fact* that replacement charges for *each* strip damaged accidentally run from 25 to 75 cents, a not inconsiderable charge against budget-ridden departments.

Nobody questions the validity of the statement that, on the cost basis, the "free replacement" comment should have been qualified, as previously stated.

We suggested that additional footage would be useful in confining any potential damage to an area of the strip which does not contain pictorial information. The manufacturers state that at a recent meeting in Chicago they adopted a recommendation for additional leader film. They say that this change was adopted for the simple reason that certain filmstrip projectors require extra length "so that the *entire mechanism* could be engaged before the first picture was on the screen."

Relatively unimportant is the fact that the precise reason for additional leader may differ from the one assigned by us. We are aggressively more interested in the fact that such a change will make the use of filmstrips more satisfactory. The concensus stemming from a survey conducted by IP is that damage to opening frames used for threading purposes was "quite common in some of the earlier projectors where the gates swung open and it was necessary to properly place the filmstrip on the feed sprocket".

The manufacturer quite correctly points out that projectors manufactured today in almost every case provide for push-in threading, but there are many who are forced to use obsolete equipment. Damage to opening frames *does* occur all too frequently on *any* equipment under certain conditions; we repeat that those who experience difficulty in this regard would do well to add more leader to filmstrips until such time as the new manufacturers' recommendation is generally adopted.

Religious Film Guide

PURCHASERS OF religious films and strips may obtain the 4th Edition of "Audio-Visual Resource Guide," published by the Department of Audio-Visual and Broadcast Information, National Council of Churches, 257 4th Avenue, New York 10, N. Y.—a useful addition to the A-V library. Purchasers of items in the religious field will find this objective evaluation of materials by an impartial committee of invaluable help, particularly in saving hours of screening time.

THOSE WHO READ the item "New Filmstrip Sound For The Old," (IP for November 1958, p. 14) might do well to observe closely the automatic slide projector described in the same issue (p. 17). If the features of manual operation need be retained, we emphasize that a two-channel recorder of the stereophonic variety may be used without costly modification for producing transport signals which are inaudible to a group.

The accompanying illustration shows the steps required for this type of operation. Here we have reserved the second track of the tape for the signal which indicates a change of slides to the operator. While this method does not permit of the automatic operation of the projector, it may serve those organizations which may not immediately be able to make use of the fully-automatic equipment.

NEVER allow the heat filter to remain out of the light path.

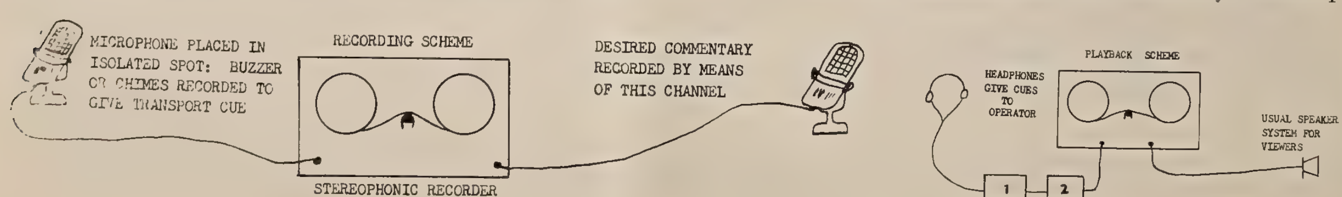
Serious damage may result to the center and end frames of a strip by the removal or breakage of the heat filter.

ONE YEAR AGO, we were asked to furnish song slides for a children's Christmas party. The type desired were in the popular vein such as "Rudolph, the Red-Nosed Reindeer," "Jingle Bells," *etc.* It was a distinct surprise to us in consulting normal channels that such filmstrips or slides are not readily found. Perhaps some of our readers have had similar experiences.—JOSEPH F. HOLT.

R. A. Mitchell Comments

WITHOUT SOLICITATION, and as a contributing editor to IP, I was intensely disturbed to read on the advance galleys that Mr. Holt's presentation in the October issue was deemed by a filmstrip

Showing simple arrangement to provide film transport cues to filmstrip projector operator. The boxes in the playback scheme indicate the point at which volume attenuation and impedance matching devices may be inserted. The box No. 1 represents a suitable resistance pad; box No. 2 indicates a transformer or resistance matching pad.



manufacturer as "inaccurate" and "inadequate."

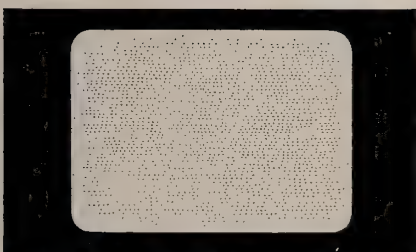
The critique by the filmstrip manufacturer picks only at straws. Without going into this in detail, there are two points I wish to mention.

There are sufficient obsolete filmstrip projectors in the schools to make leader damage a problem even today. The automatic or semi-automatic slide projector with its remote-control button and tray-loading is now a commonplace and extremely popular with teachers, the great majority of whom recognize the very same classroom advantages discussed in Holt's article.

As for use of silicones on filmstrips (Film-Magic cloth), I feel that the filmstrip manufacturer would do better to lacquer the emulsion side of his strips.

What Happens? Just This

"Mazda" screen illumination with Conventional Condensers



"Mazda" screen illumination with Relay Condensers

When the conventional condenser system is used in a Mazda lamphouse, the image of the filament on the film aperture produces a "streaky" field of light. This defect is overcome by the relay-condenser system which focuses the lamp filament—*not* upon the picture aperture but upon a relay lens which, in turn, images the smoothly-illuminated main condenser upon the aperture.

Not at all Quiet on the Filmstrip Front

The appended commentary upon the article "Notes on Filmstrip Technique," by Joseph P. Holt, which appeared in IP for October last (p. 15) was contributed by a manufacturer of filmstrips who prefers to remain anonymous. Reluctantly, IP accedes to his request, but avidly commits his comments to print.

REGARDING "Notes on Filmstrip Technique," by Joseph P. Holt, in your October issue (p. 15), in the second paragraph is the statement that "some manufacturers offer free replacement of strips which may have been damaged in use." Actually, I believe that the majority of filmstrip manufacturers have a replacement policy for strips that have been damaged accidentally. Charges for this replacement service, as a rule, run anywhere from 25 to 75 cents for each strip, which are usually considered as "handling" rather than "replacement" charges.

Since we produce and send a great many of our strips out for preview, we are quite aware of the damage which occurs. The article states that the most common trouble is with that portion of the strip used for threading into the feed-sprocket of the projector. This type of damage, we believe, was quite common on some of the earlier projectors where the gates swung open and it was necessary to properly place the filmstrip on the feed sprocket. In some of the older machines this was quite difficult to do without damaging or puncturing the strips.

Sketchy Leaders Present a Prime Difficulty

Almost all modern projectors use a push-in threading system, thus this particular type of damage happens very rarely. In fact, as a recent meeting of filmstrip producers, in Chicago, there was set up a recommendation for standards on strips which allows more leader. This, however, was not for the reason implied in the article, but because certain strip projectors required a few extra frames so that the entire mechanism could be engaged before the first picture was on the screen.

As for repairing strips with Mylar Tape, of course this is a satisfactory way of doing it, but, as previously mentioned, because of the low replacement cost by most producers, it is generally held that replacement would be far more desirable and less costly than mounting between glass.

True, strips are damaged from time to time in the middle of the film. This type of damage, we believe, is not caused by the operator but by failure of the equipment, because the heat filter has either been broken or removed, and not replaced. The strip at this point sticks to the aperture glass: when the operator attempts to advance it, the sprocket holes are torn and, perhaps, the strip itself.

Regarding the placement of reference numbers on each frame. Using the average school strip, we believe that a reference number on each frame is in the minority. Most school strips have captions—the "silent" version. Identification numbers are used in some cases, but most frequently are used with "sound" strips.

Proper Equipment Dictates Procedure

You refer to the automatic-type slide projector. Very few schools, percentage-wise, own this type of equipment. For industrial use, perhaps where a small quantity of slides are ordered, the automatic-slide projector is used. When a large quantity is used, however, strips are a great deal cheaper.

Filmstrips are usually projected to "trigger" discussion rather than just to show pictures. Proper use of the strip in the classroom will cause the operator to vary the amount of time that each picture appears on the screen, depending upon the students' reaction.

Most of the filmstrip producers today use different film hardening and lubricating processes, and, as a result, a great deal of scratching and finger-marking will, with increasing refinement of processes, be gradually eliminated.

Harwald's Equipment Catalog

THE HARWALD CO. has issued a comprehensive catalogue of A-V and, in general, film-handling equipment. Comprising 32 pages, this compendium presents complete specifications of every unit needed to present, preserve and store practically every item that would be required for the effective presentation of an A-V program—whether educational, industrial, fraternal, or what has one.

Harwald policy is that any client anywhere may phone the company *collect* and be advised upon the proper procedure for any given set of circumstances. A copy of this catalogue would

(*Continued on page 21*)

In the SPOTLIGHT

Iterate and Reiterate Anent "Videotape" Technique

NOT very many days ago we had the pleasure of a visit by one of the sales engineers for Ampex Corp., Redwood City, California, who, in the course of a lengthy and wholly informal chat stated that our remarks on "Videotape" in this space for the issue of November last could be decisive for the future welfare of the craft. (In passing, he noted that the term "Videotape" is an Ampex trademark.)

The opening paragraph of our November commentary stated:

"Standing on the pier and watching the boat sail out need not be the experience of the organized craft if it takes a good long and hard look at the onsurge of tape recording and reproduction, aural and visual, and thus sidestep the debacle which overtook them in the formative years of TV when a rank non-show business entry usurped their rightful functions."

We went on to recount how the alert and aggressive leaders of both projectionist and film-editor Local Unions were assigning groups of 20-plus of their better men to take a course of instruction in the theory and practice of the burgeoning Videotape processes.

"Nothing that you can do for your people is more important than hammering away constantly on this need for immediate and concerted action on their part to acquaint all of their men with at least the fundamentals of Videotape," said the Ampex representative. "While it might be said that we at Ampex have a selfish interest in such projects, because of our position of leadership in the manufacture and sale of such equipment, and while we know that our equipment to function at peak efficiency requires know-how by those who handle it, your function as a craft organ is, so to speak, to spread the gospel in terms of craft welfare."

No psalm-singing exhortation this; let the foregoing speak for itself.

• HIGH-COURT SENIORITY RULING: The Supreme Court of Minneapolis has ruled that a Union projectionist who was "bumped" off the job on the issue of seniority is not entitled to, nor is the theatre owner liable for, unemployment insurance benefits. In many areas the common practice is for a senior member to "put in for" the job of his preference. The man then "bumped" ordinarily would apply for and get unemployment insurance.

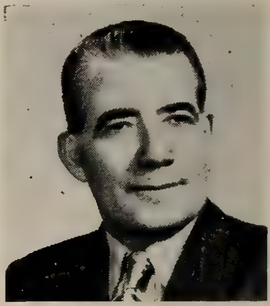
Not so, said the court, because the man was "not fired without cause" but rather was "relieved of employment" through no action by the employer. This decision, handed down after a sequence of appeals from three State employment agencies, is expected to have a far-ranging effect upon rulings in similar cases.

• Submitted by the eagle-eyed Eddie Lachman, president of Carbons, Inc. (Lorraine), and recently elected honorary life member of the 25-30 Club of New York is the following:

An item from the Newark (N. J.) Star-Ledger reporting that one Edward C. White, president of the New Jersey Pharmaceutical Association said that the "personal health of millions of Americans would be better if they turned off their sets and went to the movies. Pharmacists are experiencing too many patrons depending upon self-medication huckstered on TV for headache-relief symptoms, which could easily be caused by eyestrain from watching TV too much."

Exhibitor organizations should promptly engage Mr. White for a nation-wide tour of civic clubs.

• Another signal honor has been paid Larry Sabatino, charter member of IA Local 650, Westchester County, N. Y.,



Larry Sabatino

by virtue of his election as president of the Westchester County Federation of Labor, succeeding Ed Doyle (Teamsters) who held the post for the past six years. Sabatino is also a member of the Frank Rea Post, American Legion, and a former judge advocate of Post 1, AMVETS.

• Note from W. C. Whitt, who is now the Fire Chief at Red Bluff, Calif.: "Recently I left the projection field after 40 years of service. Many thanks for the privilege of reading IP, the world's finest projection magazine."

• Vigorous defense was entered by industry representatives at a recent hearing of the New York State Joint Legislative Committee on "obscene and offensive material." Practically all labor groups joined the producing and distributing forces in supporting the industry's self-imposed regulatory policy, their

AT RECENT MEETING OF N. Y. STATE PROJECTIONISTS ASS'N

Host for the meeting was Jamestown Local 266. Shown here are (left to right, front row): Charles F. Wheeler, secretary-treasurer; George F. Raaflaub, president; James J. Brennan, 1st vice-president, IATSE; H. Paul Shay, secretary-treasurer, 10th District, IATSE. Back row: James C. Naughton, National Carbon Co.; William Ingram, projection chief, Schine Theatres; three members of Jamestown Local 266: George Samuelson, vice-president; Donald Lutton, business representative, and Woodrow Wilson, president; William Lange, Mirio Carbons.

main contention being that they should not be penalized because of the methods employed to exploit "foreign" films of the Bridget Bardot type.

• PERPETUITY: Morris J. Rotker, past-president of the 25-30 Club and retired member of New York Local 306, was re-elected treasurer of Masonic Lodge Samaritan No. 1035 for the 22nd consecutive year! Rotker now graces the upper echelon of legal circles in New York City, having been appointed confidential secretary to the Hon. James W. Donoghue, justice of the Municipal Court, Second District, Bronx, N. Y.

• In an area designated Kings County (an area of N. Y. City approximating broadly Chicago's North Side) is a fellow named Harry Garfman who annually plays Santa Claus for the handicapped children patients of St. Giles, Beth-El and other hospitals in that borough. Of course, these endeavors are aided immeasurably by the all-out support of the Movie Social Club of Kings County, whose members are affiliated with New York Local 306. Garfman, incidentally, is the Local 306 business representative for both Kings and Queens counties.

• George Friedl, well-known in the professional sound projection field by reason of his association some years back with General Precision Equipment Corp. (Simplex projectors and sound systems), is now a vice-president of Litton Industries, Beverly Hills, Calif., in charge of the Electronic Equipments Division. Litton recently acquired Westrex Corp.

RCA has utilized a new device, Compressed Air Loudspeaker, to make what it calls world's loudest noise. Unit, now in developmental stage, will be used in testing vibration and sound—sensitive (both structurally and in performance) electronic parts for jet planes, missiles, rockets. CAL generates noise at 160 decibels (20,000 times louder than a TV set at top volume), may be able to throw human voice 10 miles or more.

• • •

FLASH PHOTOLYSIS will be employed in AEC—sponsored program at Illinois Institute of Technology to study basic processes by which light energy is transferred and used in liquids, solids. In experimental photolysis method, studied substances are irradiated with short light flash equivalent to 50 million watts to measure split-second changes in optical absorption spectra. Materials to be investigated are dyes which fluoresce when illuminated; certain inorganic crystals which color intensely when irradiated with X-rays.

"Stereo"—The Magic Word Today: What It Is and What It Does

Within the circle of those who are more than casually interested in fidelity of sound reproduction (and surely this is a primary consideration among A-V advocates) the word "stereo" has come to be a commonplace expression. The true significance of the term, however, is often difficult to define when wholly comprehended. Appended is the first of a series of articles which delineate in authoritative fashion the basis for, and proper rendition of, stereophonic sound. These data were prepared by Fairchild Recording Equipment Corp.*

A GLANCE at the dictionary will show that "stereo" (from the Greek) means "solid." Carrying our search a little further, we find that a "stereoscope" is an optical instrument making it possible for the user to "combine the images of two pictures from points of view a little way apart and thus get the effect of solidity or depth."

In the reproduction of sound, also, there is something lacking when music is played back through one loudspeaker. Compared with real, "live" sound, the effect is something like a black-and-white picture compared with full color. Sometimes this is called a "keyhole effect" because the music sounds squeezed together, as if coming through a small opening.

Semi-Serious Correctives

Many efforts have been made to get rid of the keyhole effect, some more successful than others. Just adding a second speaker helps some because the sound is spread out over a larger area and a better illusion is achieved. But no matter what is done, the result never sounds quite like the real thing; this can be very disappointing because distortion may be "practically non-existent" (it may really be, too), the frequency response may be "flat throughout the entire audible range," and everything else may be just right (and very expensive), and still the sound or other fails to be completely satisfying.

Consider: when we are listening to "live" music and how it differs from what we hear through our loudspeaker (or loudspeakers). With a "live" orchestra we listen with *two* ears, just as we see with two eyes. And just as each eye sees a slightly different scene (which the brain proceeds to merge into one image, and to interpret in space because of that very slight difference in the two images), so each ear *hears* different images of the music being played.

The ears likewise send two slightly different "images" of the orchestra to the brain, which then proceeds to interpret the blended image in terms of location of the instruments in space. Thus, we hear that the woodwinds are on one side of the orchestra and the strings on the other, and more.

But, important as this is, there still is another effect, and this is a clearer perception of the *tone* quality of each instrument. When listening to a composite musical sound it is much easier to hear the instruments separately, and to identify their tone colors, if even a small amount of *space perception* is present. This is probably the main reason why even the best sound systems do not sound quite as "clear" as the real, original sound.

"Loudness" is Not "Fidelity"

The next time you attend a concert or any musical event put your hand over one ear so that you are forced to listen with only one ear. The first thing you will notice will be the apparently large decrease in *loudness*. If your hearing be normal, you will, in fact, probably be quite disturbed, thinking that the unshielded ear must be partially deaf, since the loudness is decreased so noticeably.

But you can quickly reassure yourself on this by "trading ears" and covering the other ear. You will find that neither ear alone is half as good—even in loudness—as two together! This is the first interesting observation about binaural, as compared with monaural, listening.

After that, keep your ear covered a minute or two, or until the loudness again seems to be about normal. You will then realize that what you are hearing sounds very much like an excellent sound reproducing system (only not turned up very loud!). You will have a vague sense of uneasiness and restriction, rather hard to define, but nevertheless there.

After listening for another two or three minutes, all of this will disappear; and because our minds adapt themselves to almost any situation, what you are hearing will gradually assort itself and will sound "normal".

Now you are now ready for the big

* 10-40 45th Ave., Long Island City, N. Y.

Features of the Victor '1600' Carbon-Arc Projector

HERE IN graphic form are the salient features of the Victor "1600" carbon-arc projector. "Hard" (carbon-arc) lighting is requisite for reproducing properly those pictorial values which were graven into the photographic negative. As they say, "If a picture be worth showing, show it right."

The features of the Victor "1600" as shown in the accompanying illustration are:

1. COLOR-CODE THREADING. Color lines show how to thread, exactly where, and in easy red-white-and-blue order.

2. SAFETY FILM TRIPS. Detect trouble; stop film *before* it is damaged.

3. AIR-CONDITIOND FILM gate eliminates "baking" of film.

4. STATIONARY SOUND DRUM that scans full sound track to assure clear, smooth sound. Removable to accept Magnesound drum for magnetic recording and playback.

5. 180° SWING-OUT LENS. Facilitates threading and cleaning.

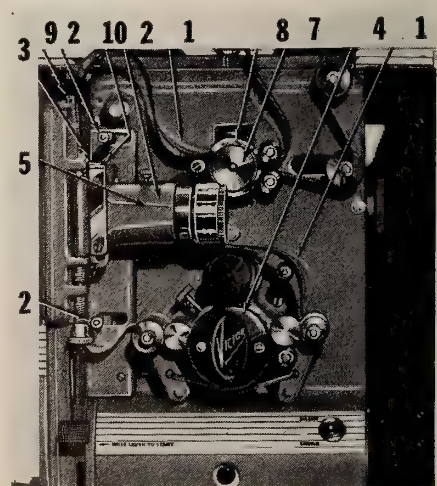
6. TOP-MOUNTED REELS. Eliminates the traffic hazard caused by overhanging reels.

7. SINGLE-DRIVE SPROCKETS. Assures uniform tension on film entering and leaving projector.

8. COMPENSATING FILM SHOES. Automatically adjust to varying film thicknesses.

9. SAPPHIRE-TIPPED DUAL FLEXO PAWLS are self-aligning to obviate torn sprocket holes.

10. ACCESSORIES. Electrical push-button changeover available for continuous showings with two "1600" arc projectors. Victor Magnasound for recording and playback of magnetic sound on striped film.



Victor "1600" carbon-arc projector

experiment. Uncover the other ear and listen again with both ears. Suddenly the instruments, which were clear and distinct enough before, will practically *jump* right out into the air in front of you! Everything sounds much louder, clearer, closer, and very much more intelligible. This is almost exactly the difference which you will observe when you listen to stereo rather than monaural sound.

Why "almost?" Because, stereo is not quite the same thing as being put into the auditorium to listen to an orchestra. Right here is where we had beter consider two words used almost interchangeably — "stereophonic" and "binaural."

"Two-Channel Listening"

Both of these words have to do with *two-channel* listening — but they are *not* the same. The best description of the difference is that "binaural" sound reproduction *puts the listener into the auditorium,* while "stereophonic" sound reproduction *puts the orchestra into the living room or classroom!*

Twenty-five years ago Bell Telephone conducted an extended series of experiments with two-channel listening and achieved results which have not been surpassed to this day. Their experiments made use of a wax dummy named Oscar. In each of Oscar's ears was located a tiny microphone, and each microphone was connected, through high-quality amplifiers, to one earphone of a headset.

The microphone in Oscar's left ear was connected to the left earphone; that in his right ear to the right earphone. Thus, when anyone put on the headset he was, in effect, hearing exactly what went into Oscar's ears, not what would go into his own.

Left- and Right-Hand Effect

The effect was startling, since there was no perceptible distortion in the system and the frequency range was very wide, providing extremely natural sound. Oscar could be seen behind a glass (soundproof) wall, and anyone walking around Oscar and talking to him could also be seen. Upon putting on the headset and looking forward at Oscar and the man talking to him, the observer would naturally expect to

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hear a sound somewhere in front of him.

To his complete surprise, however, when the phones were put on, the speaker would appear left or right (as the man was standing to the left or right of Oscar), and almost invariably the observer putting on the phones would turn in the (apparent) direction of the sound, thinking that someone had spoken to him.

Aural vs. Visual Perceptivity

The reason is quite simple: what the observer's ears told his brain was not what his eyes reported. The eyes saw a man in front of the observer; but the ears heard a man left or right, or even walking around him, if the man were walking around Oscar. So far as his ears were concerned, the observer had been transported bodily to Oscar's location, for the observer's ears heard *exactly* what Oscar's ears were hearing.

The observer's eyes were apparently deceiving him! In other words, the listener had been transported to Oscar's position, or to the auditorium, in the case of the orchestra.

[TO BE CONTINUED]

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AUDIO-VISUAL SECTION

(*Continued from page* 15)

be helpful; the address is 1245 Chicago Ave., Evanston, Ill.; the phone number is DAvis 8-7070.

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Craig Motorized Editor-Viewer For 16-mm, Sound-Silent Film

SPECIFICATIONS: 400-foot film capacity, with rewinds folding for compact, portable use, with a 3¼ x 4¼ format. Weight: under 12 pounds. Size (in inches): 8¼ high, 14½ long, 8½ wide—in a sturdy plywood case. Optics: F: 2.8 triplet lens; other optics have coated lenses for maximum light transmission. Lamp: 75-watt blower-cooled G. E. PH75T8/106 or equivalent. Screen Light Intensity: 24-foot-candles.

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The Craig motorized editor-viewer

whereby the film is run at 24-26 frames p/s without manipulation by the operator; single-frame viewing, whereby an ingenious framing operation permits instantaneous viewing of a specific frame, always a *full* frame, without any adjustment for bringing film into position. (A Kalart product.)

THE CARBON ARC

(*Continued from page* 7)

of only 0.0098 ohm at room temperature (20° C = 68° F).

Even though motor-generator sets are themselves very efficient converters of power, the necessary ballast rheostats waste much of the power produced by the generator. The wasted power is transformed into heat. Rectifiers also waste power, converting it into heat. There is actually not much difference between the efficiency of a motor-generator set with ballast rheostats and a selenium rectifier. Rectifiers do not need ballast resistances, but the rectifier stacks, themselves, waste about 20% of the current.

Projection-arc rectifiers are self-regulating devices by virtue of the AC reactance of the transformers employed on the AC power-input side. Transformers draw from the AC line only the amount of current actually consumed by the load connected to their primary windings (rectifier and DC arc). so they waste no power.

Rectifiers are very economical to purchase and maintain in good operating condition. Many lamp manufacturers supply rectifiers designed for use with their own lamps, e. g., the Strong and Ashcraft selenium rectifiers. It should be noted, however, that whereas one multiple-arc generator set is sufficient for a 2-arc installation, a rectifier can supply power to only one arc. For a 2-projector installation, therefore, two rectifiers are needed.

The smoothest arc current, independent of minor AC power-line voltage fluctuations, is furnished by motor-generator sets. Properly adjusted rec-

tifiers, however, do not introduce noticeable flicker into the projection light where AC input voltage is constant. It is only in certain rural areas having faulty mains current that the use of rectifiers causes severe picture flicker.

Carbon-Feeding Devices

Once the correct arc current, voltage, and arc-gap distance have been established, the lamp carbon-feeding mechanism should preserve these factors unchanged. The feed mechanisms for most of the smaller and older lamps are current-operated devices that maintain a constant arc current and, in consequence, a fairly constant arc gap. The feed mechanism's job has been made more difficult by fast-burning H-I carbons.

The old-style intermittent-feed type of control utilized a relay switch connected in parallel with the arc. As the arc gap increased, due to the burning-away of the carbons, more current passed through the relay electromagnets which turned the feed motor off and on. With sufficient current, the relay switch closes, causing the feed to operate. When the arc gap is thus reduced in length, the relay opens and the feed motor stops. Dirty relay contacts and incorrect spring tension were the chief causes of feeding trouble.

Most Suprex-type lamps employ a special feed motor having a heavy-current field winding connected in series with the arc. Lengthening of the arc gap as the carbons burn away causes a decrease of current through the control field of the motor. The motor then speeds up. As the gap shortens, the current through the control field becomes stronger, and the speed of the motor decreases.

Modern high-powered lamps employ optical crater-positioning feeding mechanisms. An image of the crater is focused either upon a bimetallic-strip thermostat or upon a photoelectric cell. Operation of the thermostat or photocell by the action of either heat (infrared rays) or light emanating from the crater controls the carbon-feeding motor and maintains correct crater position within remarkably close limits. "Photronic" arc control is undeniably the most satisfactory for fast-burning, high-powered H-I carbon trims.

While fully automatic carbon feeding by photronic controls is independent of arc-current variations, the older relay and control-field devices are extremely sensitive to all electrical factors involved in the burning of an arc. Each is fitted with an adjustment which permits the projectionist to vary, within reasonable limits, the current which actuates the feeding mechanism.

In the case of the relay type of control, the adjustment is made in the tension of the relay contact spring against which the electromagnet works; in the case of the continuous-operation feed motor of simplified H-I lamps, a manually operated shunt-field rheostat is used. It should be kept in mind that any defect in the power supply or arc circuit which causes an accidental reduction in current will result in fast carbon feeding and a radically shortened gap with either of these two feed devices.

Separate Negative Feed

It should also be remembered that a single ratio of negative feed-rate to positive feed-rate works satisfactorily *at one amperage only*. If the current be increased, the negative carbon will burn faster in relation to the positive burning rate, and the feed mechanism will cause the entire arc to creep slowly toward the mirror.

Likewise, a decrease of current causes the arc to creep slowly away from the mirror *even though the correct arc gap is maintained at all times.*

This is one of the difficulties of operating older lamps, such as the Simplex High, which had no separate negative-feed adjustment. The only way to make these lamps burn properly without an undue amount of manual adjustment is to regulate the arc current very carefully by means of the generator field rheostat. Rapid arc creeping caused by abnormally high or low current calls for a little experimenting with larger or smaller negatives.

Correct setting of the arc-feed mechanism, including the separate negative speed control, is undoubtedly the most critical electro-mechanical aspect of arc-lamp operation. But once these adjustments have been properly made, there should be little need to alter them radically unless the arc current is changed or different sizes of carbons are used.

The necessity for clean, properly lubricated lamp mechanisms and good electrical connections throughout is well known to all projectionists.

Panoram Par-Excellence

In the Philips pavilion at the Brussels World Fair performances were given of "Electronic Poem," a combination of light effects and electronic music involving extensive technical provisions.

The equipment for the light effects included four large cinema projectors, eight projection lanterns, six spotlights, six ultra-violet lamps, 50 electric bulbs representing stars, and several hundreds of tubular fluorescent lamps in various colors. The luminous flux of most of these light-sources is variable by means of 30 thyratron control circuits.

The electro-acoustical installation comprised a special playback machine with a three-track perforated magnetic tape on which is recorded a composition by Edgar Varese, 20 amplifiers each with an output of 120 W, 350 loudspeakers, and an elaborate switching system with relayed and telephone selectors.

The electronic control system employed a second playback machine, which scanned a 15-track perforated magnetic tape. Twelve control signals differing in frequency are recorded on each track, so that 180 channels are available for controlling the light-and-sound effects in accordance with the scenario. Both playback machines are duplicated, with a view to providing a reserve as well as ensuring continuous performances.


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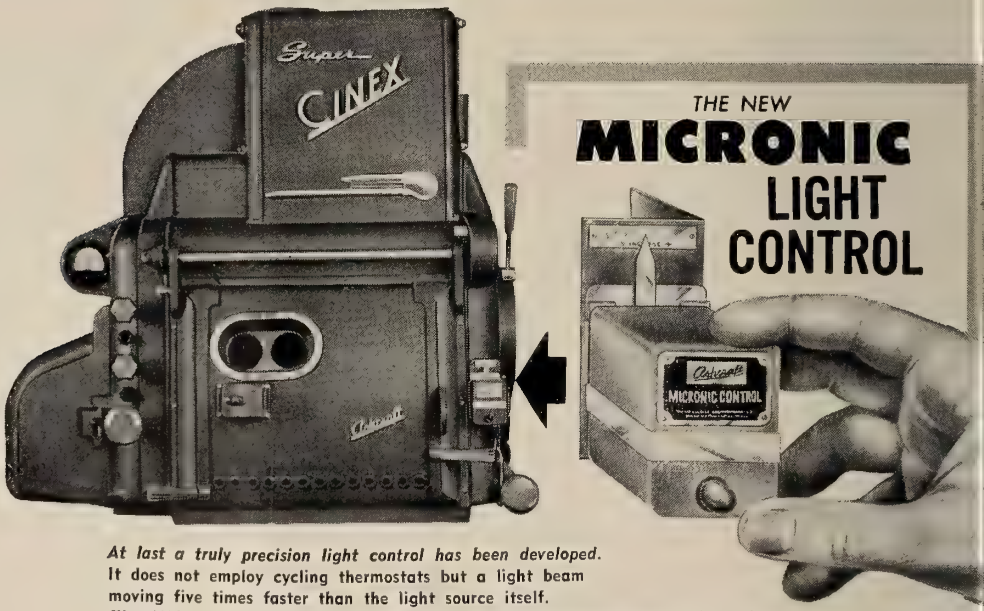

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Monthly Chat

Joint Industry Technical Effort

GRATIFYING indeed was the favorable response by IATSE, representing the organized crafts from studios to theatres, to the appeal by the Theatre Owners of America for a concerted effort in launching and maintaining a nation-wide projectionist training program. Sponsors would be, in addition to TOA and IATSE, equipment manufacturers and dealers and the service companies, Altec and RCA.

Only last month in this space we lamented the cessation of activity by the IA-manned field-team which was sponsored by the Motion Picture Research Council. This team inspected more than 700 theatres in more than 100 cities, including drive-ins. Their findings are nothing less than a disgrace to the industry.

Just a quick rundown of the major deficiencies exposed by the survey: common lack of image focus, screen brightness levels which in a majority of theatres was less than half the minimum standard, incorrect focal length of lenses for the particular situation, faulty screen masking, and damaged prints.

The drive-in theatres were revealed to be in a desperate plight on the score of screen brightness. In 57% of the drive-ins visited screen brightness level was less than 3 foot-lamberts, and in only 5% was the level slightly over 5 foot-lamberts! This situation is almost incredible to anybody having even a modicum of projection know-how.

As for print condition, the findings revealed the following *major* deficiences: 1, scratched prints; 2, unrepaired damaged splices; 3, damaged leaders, leaders of improper length (footage missing), leaders not spliced to reel, and missing leaders; 4, damaged bent reels; 5, damaged film containers (especially the cardboard type recently put into service).

Sad indeed is it that the end result of all production effort, the image projected onto the screen, is only now exciting the interest of exhibitors, who for years regarded projection as a necessary evil. However that may be, IP applauds George Kerasotes, new president of TOA, for his initiative in forcing recognition of the fact that "exhibitors' only merchandise is the screen image."

IP shuns any impassioned defense of the projectionist craft for the situation aforementioned (we're sure no little blame therefor accrues to them) but it is interesting to note that on the score of film damage it was commonly agreed that the film was *delivered to the theatre* in a sad state, necessitating extra and fast work by projectionists to effect repairs. The culprit on this score is of course the exchange, where the cursory inspection routine has been a joke for many years. The Council report stated:

"Some among management have seemed too prone to criticize projectionists. Blanket criticism does not, of course, solve anything, and in this case cannot be justified in the over-all picture. It has been the experience of the Council theatre staff that projectionists, as a craft, are conscientious, competent, and show an above-the-ordinary interest in their jobs that is praiseworthy. In one city, for example, 14 projectionists spent half a day on their own time at theatres being visited by a Council field man.

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INTERNATIONAL PROJECTIONIST

Volume 34 FEBRUARY 1959 Number 2

PROJECTION SCREENS for 16-mm Film Showings

By ROBERT A. MITCHELL

Given the best of equipment, ideal viewing conditions, and even extreme competence in operation, the quality of the reflected image depends upon the use of a proper screen surface. Various conditions of viewing require the employment of different screen surfaces, lenses, and careful advance preparations. Herein are detailed the requisites for optimum viewing conditions under differing circumstances.

THE visual effectiveness of professional motion pictures depends in great measure upon the size, placement, and light-reflecting characteristics of the screen. Projection conditions in the average classroom, or auditoria used for presenting industrial films, are seldom as good as they are in the average theatre; but this unavoidable fact increases, rather than diminishes, the need for intelligent projection planning by those who desire the best results from their audio-visual programs.

Both portable and roll-up wall screens are available in a wide variety of types and sizes. There are "beaded" screens for high picture brilliance over a narrow viewing area, and there are "matte" and "pearlescent" screens for wider seating areas and higher visibility of the fine-image detail which is often important to full appreciation of the subject matter. The screen suited to one kind of projection process, or to one kind of room, may be quite unsatisfactory under different conditions.

Screen Placement, Size

The first consideration anent any screen is its placement. Every viewer must be able to see it without physical strain, and its light-reflecting surface must be shaded from ambient light. This decided, the question posed is:

"Will the picture projected be large enough, bright enough, and clear enough for the most effective presentation of the films or slides?"

The optimum size of a screen is related to the size of the audience: the larger the audience, the larger must be the screen. Assuming that the viewers are arranged in a normal square or rectangular seating area, the required width of the projected pictures (whether from 16-mm film, 35-mm filmstrips, or slides) is indicated by Table I.

As a general rule, no one should be seated closer to the screen than *twice the width* of the projected picture, or farther away than *six times its width.* This rule presupposes the standard picture format which specifies a picture height ¾ of its width—an "aspect ratio" of 1.33/1.

To apply this rule, divide the distance between the rear row of seats by 6. For a 30-foot "maximum view-

PERSONS IN SEATING AREA		REQUIRED WIDTH OF PICTURE (Approximate)
NORMAL	PRACTICABLE LIMITS	
25	20 - 30	40" (3'4")
40	30 - 50	50" (4'2")
60	50 - 70	60" (5')
80	70 - 90	70" (5'10") or 72" (6')
100	90 - 125	7'
150	125 - 175	8' or 9'
200	175 - 250	10'
300	250 - 350	12'
400	350 - 500	14' - 16'

TABLE I
Showing the relationship between persons in seating area and screen sizes.

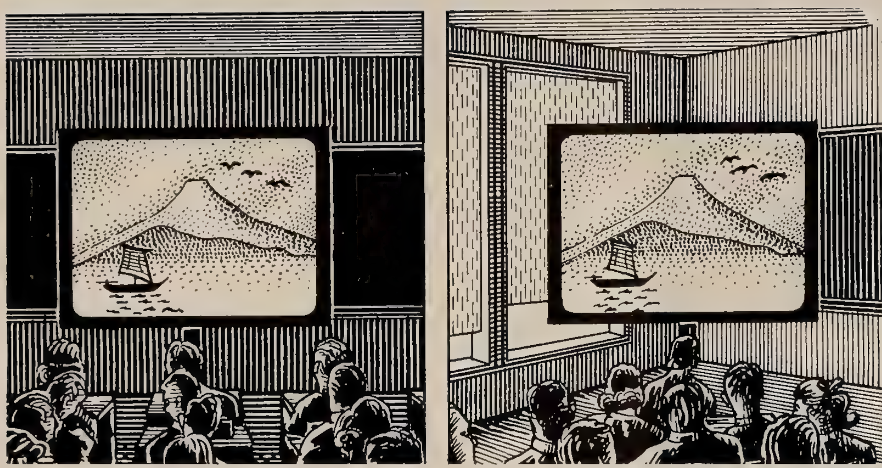

FIG. 1. The projection screen should be set up to face the rectangular seating area squarely for maximum audience capacity. When the room cannot be adequately darkened, however, it is best to place the screen in a corner facing away from the imperfectly shaded windows. The seating area then becomes diamond-shaped.

ing distance," therefore, the projected picture should be 5 feet in width. Twice this picture-width is 10 feet, which in this example is the recommended distance between the screen and the front row of seats.

A motion-picture screen should be an inch or two larger each way than the projected picture itself. This allows for a small margin around the picture and eliminates the possibility of "overshooting" the screen with attendant distractions for the viewers. Small discrepancies in projector-to-screen distance, or in the focal lengths of lenses, may result in pictures slightly larger than the calculated sizes.

Rectangular or Square Shape?

Should screens be rectangular or square in shape? Rectangular screens of the conventional 4:3 proportion are preferred for motion-picture and filmstrip projection for a neater, more professional effect. Square screens are nevertheless considered more serviceable for 2" x 2" slides, which may be oriented either vertically or horizontally, for 4" x 3¼" slides, which are generally projected through relatively square-shaped masks, and for opaque projection. Even the smallest school, for example, should have both kinds of screen for specific visual-education purposes.

A projection screen should be placed high enough to prevent the heads of observers in the front rows from obstructing the sightlines of the persons behind them. Equally important, the portable screen should be located to prevent extraneous light from imperfectly-shaded windows from falling upon the projection surface.

It may be necessary to place the screen in a corner of the room facing away from the windows, as shown in Fig. 1; but even this expedient has its advantages. The extreme front-row viewing angles which foreshorten the picture and cause eyestrain are eliminated by the diamond-shaped viewing area.

The required screen size calculated by dividing the maximum viewing distance by 6 poses difficulties when the luminous power of the projector is too low for adequate picture brightness. A dim, hard-to-see picture is not an effective communication tool.

A blank-screen brightness of 9 or 10 foot-lamberts of surface brightness when the projector is run *without film* is the minimum standard for 35-mm movies in theatres. This level of screen brightness is also satisfactory for 16-mm projection, inasmuch as the photographic densities of both 35-mm theatre-release prints and 16-mm instructional films are similar.

As a concession to 16-mm tungsten-bulb projectors, which are much less powerful than the high-intensity carbon-arc projectors used in theatres, a minimum-brightness level of 5 foot-lamberts is considered acceptable in well-darkened rooms.

Brightness Level vs. Size

How large a picture will *your* 16-mm projector give at the minimum brightness level of 5 foot-lamberts? Although different projectors and lenses have different luminous efficiencies, Table II provides at least an approximate estimate of the picture-size capacities of 16-mm machines having 110—120 volt bulbs of various wattages.

A 750-watt 16-mm projector, for example, is capable of throwing a picture 5—6 feet wide on a matte screen at the minimum acceptable brightness level of 5 foot-lamberts. A classroom in which the last row of occupied seats is from 30 to 36 feet from the screen can be satisfactorily served by a 750-watt machine.

Larger pictures from this particular projector will be too dim (unless a beaded screen be used with severe restriction of the angular width of the viewing area), but smaller pictures will be brighter and, in most situations, more effective. A 4-foot picture, for example, conforms to the professional 10-foot-lambert standard; while a picture 2½—3 feet in width represents the 20-foot-lambert level which prevails in the better modern theatres.

Still smaller pictures will be *too bright*. Excessive picture illumination raises the perception of shutter flicker above the threshold and thereby

TABLE II: Recommended picture sizes for 16-mm projection on matte screens.

POWER OF PROJECTOR LIGHT	MINIMUM PICTURE WIDTH 20 footlamberts	RECOMMENDED PICTURE WIDTH 10 footlamberts	MAXIMUM PICTURE WIDTH 5 footlamberts
300-W Bulb	1' - 1½'	2'	2½' - 3'
500-W Bulb	1½' - 2'	3'	3½' - 4'
750-W Bulb	2½' - 3'	4'	5' - 6'
1000-W Bulb	3' - 3½'	5'	6' - 7'
1200-W Bulb	3½' - 4'	6'	7' - 8'
30-amp. Arc	6' - 7'	10'	12' - 14'

TABLE III: SIZES OF PICTURES IN 16-MM PROJECTION

(Upper Number is Width of Picture; Lower is Height)

Computed on the basis of the standard ASA 16-mm projector aperture, 0.380" x 0.284"

PROJECTION DISTANCE IN FEET	FOCAL LENGTH OF PROJECTOR LENS (INCHES)							
	3/4	1	1½	2	2½	3	3½	4
10	5' 1" 3' 9"	3'10" 2'10"	2' 6" 1'11"					
15	7' 7" 5' 8"	5' 8" 4' 3"	3'10" 2'10"	2'10" 2' 1"	2' 3" 1' 9"			
20	10' 2" 7' 7"	7' 7" 5' 8"	5' 1" 3' 9"	3'10" 2'10"	3' 1" 2' 3"	2' 6" 1'11"	2' 2" 1' 8"	
25	12' 8" 9' 6"	9' 6" 7' 1"	6' 4" 4' 9"	4' 9" 3' 7"	3'10" 2'10"	3' 2" 2' 4"	2' 9" 2' 0"	2' 5" 1'10"
30	15' 2" 11' 4"	11' 5" 8' 6"	7' 7" 5' 8"	5' 8" 4' 3"	4' 7" 3' 5"	3'10" 2'10"	3' 3" 2' 5"	2'10" 2' 1"
35		13' 4" 9'11"	8'10" 6' 8"	6' 8" 5' 0"	5' 4" 4' 0"	4' 5" 3' 4"	3'10" 2'10"	3' 4" 2' 6"
40		15' 2" 11' 4"	10' 2" 7' 7"	7' 7" 5' 8"	6' 1" 4' 7"	5' 1" 3' 9"	4' 4" 3' 3"	3'10" 2'10"
45			11' 5" 8' 6"	8' 7" 6' 5"	6'10" 5' 1"	5' 8" 4' 3"	4'11" 3' 8"	4' 3" 3' 2"
50			12' 8" 9' 6"	9' 6" 7' 1"	7' 7" 5' 8"	6' 4" 4' 9"	5' 5" 4' 1"	4' 9" 3' 7"
60			15' 2" 11' 4"	11' 5" 8' 6"	9' 1" 6'10"	7' 7" 5' 8"	6' 6" 4'10"	5' 8" 4' 3"
70				13' 4" 9'11"	10' 8" 7'11"	8'10" 6' 8"	7' 7" 5' 8"	6' 8" 5' 0"
80				15' 2" 11' 4"	12' 2" 9' 1"	10' 2" 7' 7"	8' 8" 6' 6"	7' 7" 5' 8"
90					13' 8" 10' 3"	11' 5" 8' 6"	9' 9" 7' 4"	8' 7" 6' 5"
100					15' 2" 11' 4"	12' 8" 9' 6"	10'10" 8' 1"	9' 6" 7' 1"

introduces an element of discomfort in the viewing of motion pictures.

As a general rule (to which there are numerous exceptions) 16-mm projectors for school use should have bulbs at least as strong as 750 watts. A 750-watt projector will serve small classrooms; while a 1000-watt machine will serve large classrooms and small assembly halls.

Larger auditoria requiring screens wider than 7 feet must resort to the use of carbon-arc projectors connected to fume-exhaust flues, powered by rectifiers, and housed in a projection booth. These, like powerful theatre projectors, should be operated by skilled projectionists.

Ambient Light Level

A classroom screen, as stated previously, should be protected from extraneous light while projection is in progress. The excellent contrast-range of professional movies is due to the very low level of ambient light which reaches the screen in a motion-picture theatre.

While many visual-education authorities offer several good reasons for disapproving the taking of notes by students during the exhibition of films, there may be special occasions, as during repeat showings, when note-taking and group discussion may assist the learning process. In such cases there must be sufficient ambient light to permit the student to see his notebooks and to identify other members of the class by sight.

The intensity of ambient-light levels during projection may be specified. For "dark-room" projection, when no notes are to be written, the illumination of the room should not exceed 0.1 foot-candle. This will permit good visual results to be obtained with

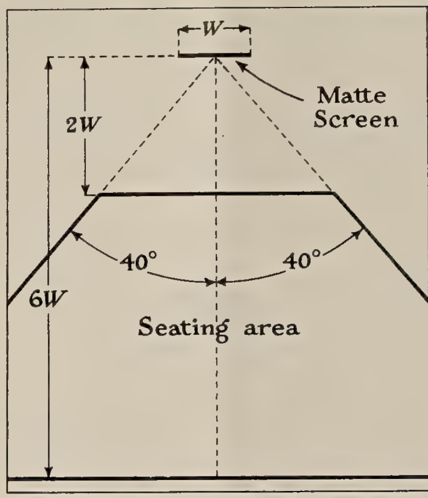

FIG. 3. The practicable viewing area for matte screens is very wide. With this "diffusive" type of screen, only the effect of foreshortening due to perspective limits the width of the viewing area. The matte screen is the best all-around type for classroom use.

screen-brightness levels of 5—10 foot-lamberts. For note-taking and group discussion during projection, room illumination should be approximately one foot-candle.

If the screen can be protected at least partially from the full intensity of the ambient light, well and good; if not, then the minimum recommended picture width (Table II) should be utilized to increase screen brightness to about 20 foot-lamberts. This is easily possible with relatively small classes, or divided classes.

The size of a projected picture can be altered by two methods. (1) The projector may be moved closer to the screen for a smaller picture, farther away for a larger one. (2) The lens of the projector may be changed to one of shorter focal length for a larger picture to one of longer focal length for a smaller picture, the projection distance remaining unchanged.

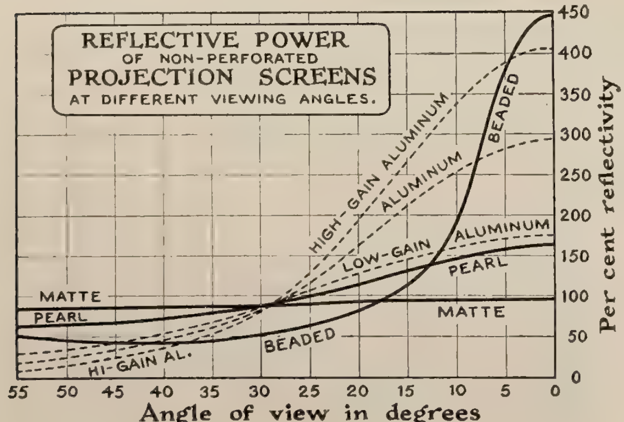

FIG. 2. This graph gives the reflection characteristics of non-perforated projection screens. Apparent reflectivity may be several hundred per cent on the center line in the case of directional-type screens. The pictures on these screens accordingly look very bright when viewed on the center line, but uncomfortably dim at extreme angles. Only the plain white matte screen furnishes uniform light distribution over all viewing angles.

An assortment of several lenses is highly desirable, and the focal length selected for a specific set-up should be such as to give the desired picture size when the projector-to-screen distance is at least as great as the maximum viewing distance. It is always a good idea to have the projector *behind* the audience, not in its midst.

Relative Brightness Level

NEVER FORGET: the relative brightness of the picture is an inverse function of its total *area*, the amount of light issuing from the projector remaining the same. Halving the width of a picture increases the brightness 4 times; doubling the width results in only ¼ of the original brightness.

The standard 16-mm projection lens

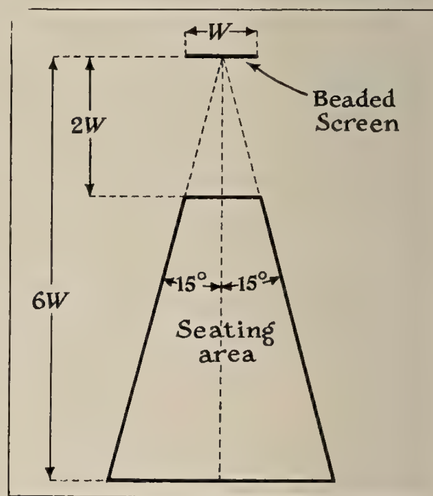

FIG. 4. The recommended viewing area for glass-beaded screens. Because of their excessive concentration of light close to the axis of projection, the picture appears very dim even at moderate viewing angles. The same effect occurs with "high-gain" aluminum-surfaced ("silver") screens.

has a focal length of 2 inches. The widely available 1½-inch lens *increases* picture-width 1.3+ times; while the 3-inch lens *reduces* picture-width 1.5 times; and the 4-inch lens 2 times.

Table III (page 7) gives the actual sizes of the pictures with a wide variety of lenses at different distances from the screen when the projector has the standard 16-mm aperture measuring 0.380" x 0.284". Use this table to select needed lenses. Table IV (page 26) indicates the size of screen for each lens and projection distance, the screen being just slightly larger than the picture. This table, which includes only commercially available

(*Continued on page* 25)

WHY

Blown Arcs Are Being Installed by Large Theatres

They are

THE ONLY LAMPS WHICH PROJECT AMPLE LIGHT FOR EVEN THE MOST MAMMOTH SCREENS!

They Bring Indoor Quality Projection to the Largest Drive-Ins, with Perfect Distribution of Screen Light of Constant Intensity and Color.

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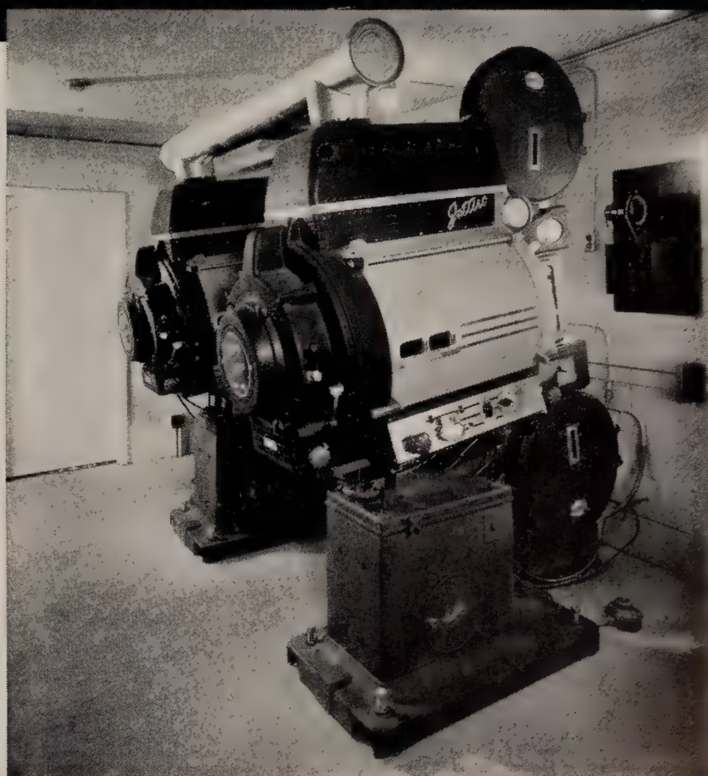

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All-Purpose Test Alignment Film Now Available from MPRC

Stemming from a survey conducted by the Motion Picture Research Council in hundreds of theatres of varying capacity and viewing conditions is the accompanying illustrative and explanatory copy relative to a test reel which, properly utilized, will convey an accurate representation of the quality of your screen image.

THIS alignment film can be used for anamorphic (CinemaScope 2.35:1) and wide-screen projection and the following checks can be made: aperture measurements, height steadiness, side-weave, travel-ghost, focus, breathing, buckling and squeeze ratio.

The target as illustrated on this page consists of the following design: the vertical center line is 0.738-inch from the guided edge and is common for both CinemaScope and wide-screen apertures. Maximum outside lines represent the 0.715 by 0.839-inch aperture. Inside this field are the dimensions of the 0.825 by 0.600-inch aperture. A horizontal center line separates the top and bottom half of the target symmetrically.

The lines on top and bottom of the chart are 0.002-inch thick and are spaced 0.010 inch. The line scales on the sides of the chart are 0.001-inch thick and are spaced 0.010 inch. Thus, horizontal and vertical scale lines will appear of equal thickness on the screen when projected at an anamorphic ratio of 2-to-1.

APERTURE MEASUREMENTS. When projecting the chart with either widescreen or CinemaScope aperture, the scale lines for height can be used directly for aperture measurement. If different numbers appear on the top and bottom of the screen, the true aperture height is the *mean* value of the two readings. If the aperture is filed off-center, it can be corrected with the help of the height scales.

In order to aid the width-filing of apertures, the vertical scale lines are longer, which will aid measurements while filing for keystoning. While using the height and width scale lines for measurement, it should be noted that the dimensions count to the outside edge of these lines away from the respective center line.

HEIGHT STEADINESS. In order to judge steadiness in height, the lines on top and bottom are used. The width of a line represents 0.002 inch and the spacing from line to line 0.010 inch. Unsteadiness in height can be checked by observing the line nearest the aperture edge and its movement on the screen.

SIDE WEAVE. To judge side weave the vertical lines on the right and left edge of the target are used. Each line represents 0.001 inch with a spacing of 0.010 inch from line to line. The amount of side weave can be checked by observing the line nearest the edge of the aperture and its movement on the screen.

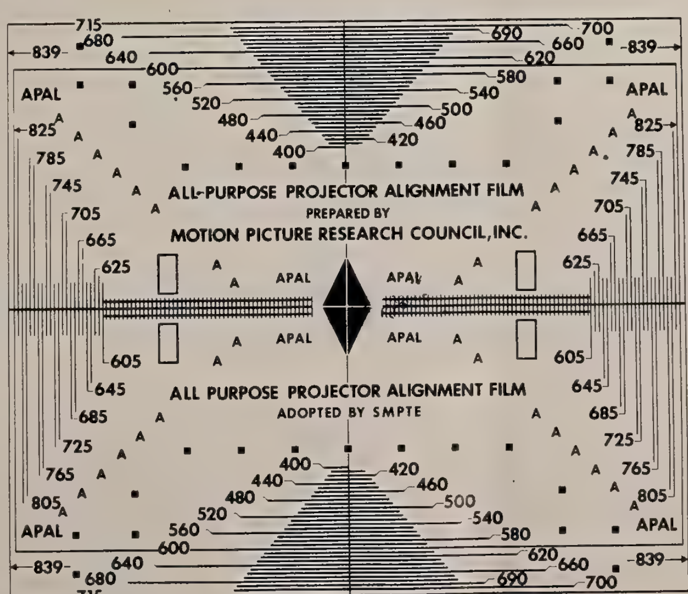
TRAVEL-GHOST. For checking travel-ghost, a pattern consisting of white square blocks is distributed above and below the main-title lettering and extended toward the four corners. These squares (converted into horizontal rectangles in anamorphic projection) will show any travel-ghost present. Figures and lettering of the chart also show travel-ghost.

FOCUS. The lettering and the fine-line fence pattern in the central area of the target are used to judge focus. The lettering allows an easy overall check of focus, while the fence-pattern allows focusing for finer detail and a check of focus from left to right across the center of the aperture. The "A" letters are of equal size and are used to check focus from center to corner.

'BREATHING' AND BUCKLING. A pair of fine black crosslines of 0.001-inch thickness is provided in the diamond-shaped pattern in the center. These crosslines will be hard to focus if substantial "breathing" or buckling occurs in the aperture.

SQUEEZE RATIO. The lettering of the chart can be read in anamorphic and wide-screen projection. A number of patterns have been designed in a 2-to-1 ratio. The rectangles to the left and right of the vertical center line, when unsqueezed, will be converted into squares. The diamond-shaped pattern in the center, when unsqueezed, will appear as a square standing on its edge.

This film is available under Code No. APAL; price 10 cents per foot, minimum length 50 feet, or increments of 50 up to 1,000 feet.



APAL Test-Film Chart

On the film the chart consists of white lettering and lines on a dark background.

Century 75/35-mm Projector Now in Production

Manufacture of the first American-made 35- and 70-mm projection and sound equipment was announced by Century Projector Corp., with deliveries to meet anticipated release schedules of 70-mm pictures now in production. The John P. Filbert Co., of Los Angeles, will be the exclusive sales agent for the equipment in the United States.

The equipment is the result of several years of research and experimentation in the design and manufacture of special film devices to handle the new wide-film processes which some of the producers have been utilizing. Several such projectors of an experimental nature were used in actual theatre tests.

Match SMPTE Standards

Century, in announcing the new equipment, said that "quality tests indicate that the types of projection as exemplified by the standards of the SMPTE and the Academy of M. P. Arts & Sciences regarding picture steadiness and sound reproduction have been obtained."

Directing the sales program for the Filbert Co. is S. L. Kantos.

Aperture-Filing for 'Keystone' Effect:

An Outline For Proper Procedure

Many moons ago, as the Indians say, I read an article in IP relative to the proper procedure for the filing-out of aperture plates so as to correct the "keystone" effect—that is, a "chopping off" on the top of the screen image. I got a sort of "fuzzy" effect on each side of my screen image.

I pose this question because it has arisen from time to time in discussions with other projectionists.

HERBERT NEWMAN
IA Local 542, Marinette, Wis.

THE "keystone" shape of the aperture image caused by excessive projection angles can be overcome by properly filing out aperture plates which are *undersize in width* (such as the G-2302, G-2303, and G-2304 Simplex X-L plates for non-anamorphic projection, and the G-2412 and G-2413 plates for CinemaScope).

Filing the apertures does nothing to correct keystone distortion and elongation of the picture image itself. Such distortion can be overcome only by the use of special projectors manufactured in Europe.

Normally, the length of the bottom edge of an undersize aperture should be increased to *normal* width (0.825 inch), while the final length of the top edge depends upon the *amount* of keystoning to be overcome. The two sides are finally filed to straight, smooth edges which will slant in toward each other slightly.

An aperture thus filed out has a keystone shape, but this counteracts the optical keystoning caused by projection angle to give a rectangular aperture image on the screen. But, as stated above, the picture, itself, still will be distorted.

Procedural Suggestions

There are several ways to determine the amount of filing needed to impart the proper shape to the finished aperture. The correctly-masked blank screen illuminated by the stage strip and footlights may be photographed on a piece of unexposed raw 35-mm negative placed in the aperture of the projector and exposed for a few seconds. The film, when developed, shows the screen as a black trapezoidal area of the correct size and shape. Most projectionists, however, file apertures by trial and error, frequently testing the results by projection on the screen.

Another good method is to place a regular rectangular aperture in the projector and measure the width of the image along the top, then along the bottom, of the screen. If the width at the bottom of the image is 24 feet, and the width at the top is 22 feet, simple arithmetic reveals the exact dimensions required for the filed-out aperture.

Assuming that the length of the bottom edge of the aperture will be increased to standard width (0.825 inch), multiply 0.825 by 22 (top) and divide the answer by 24 (bottom). This gives 0.756 inch, the required length of the top edge of the aperture (which will show on the bottom of the screen, of course).

Marking this out on the aperture plate, connect the corners by accurately scribed lines and file out very carefully. Avoid *over*filing (brass is soft!) and test from time to time by actual projection.

The sides of the projected image will not be "fuzzy" if the aperture has been accurately dimensioned and the sides filed out smoothly. Use a very fine flat magneto file for finishing. Move the screen masking in at the sides, if necessary, to cover up the actual projected image of the aperture.

IP LETTERS TO THE EDITOR

Lamp Filament Warm-up

To the Editor of IP:

Relative to the article on 16-mm film by R. A. Mitchell (IP for December last), no one will dispute his approach to the gradual heating of lamp filaments of the 750-1000 watt type. In the old 30-volt, 900-watt days one manufacturer used a control device consisting of a long, finely-threaded rod which left the projectionist exhausted by the time the advanced position was reached.

However sound, the slow-heat approach is impractical. With the improvement in high-temperature metals and better filament suspension within the lamps, we have encountered very little trouble from this source during the past ten years.

As many as 100 people may operate a 16-mm unit in the school system of a city of 50,000 population. Lamp blisters may be lessened by running the projector motor for one minute after projection ends.

ALLISON ALBEE
Albee Enterprises, Rye, N.Y.

Kudos for R. A. Mitchell

To the Editor of IP:

The article on screens in IP for November last (Are Lenticulated Screens Practical?" by Robert A. Mitchell) is the first that has ever made me feel disposed to write and congratulate the author. It is refreshing to see figures which have some revelance to the facts of life.

I have been developing lenticular screens and surrounds since before World War II. I produced the first lenticular silver screens, which made large-screen TV possible, for the Rank Organization in the late 1940's, and I put the first curved lenticular screen in the world in at the Festival of Britain, where we showed 3-D in 1951. Many of my screens were flown to America in the first flush of 3-D.

I find Mr. Mitchell's forthright views on most subjects near to my own. The pity is that the few personalities who could and should influence trends towards the future life and prosperity of our industry do not read Mr. Mitchell's sort of article. So, we continue with a policy of drift.

J. L. STABLEFORD
Stonebridge Park, London, England

Salute From the Antipodes

To the Editor of IP:

We have only lately formed the "I.C." (Inner Circle) in Brisbane, Australia, but our parent bodies in Sydney and Melbourne have done 20 years or more of good work in the projection field.

Technical and social activities are carried out by this body of men who work within the Union. Meetings and lectures are monthly. Another of our activities is rostering our members and providing a show for spastics, orphanages, and an occasional hospital ward once a month.

We want you to know how much we appreciate the IP for the excellence of its technical articles and also its outspoken policy and fairness on controversial subjects.

Firm fellowship greetings and best wishes for the coming year from:

INNER CIRCLE OF PROJECTIONISTS
Queensland, Australia

Glass Aperture Pressure Plates To Control Film Buckle?

Not infrequently in articles appearing in IP it is stated that large film used for more brightness and better definition is not preferable because the extremely hot light causes the film to flutter and it is impossible to maintain focus. Has it ever been tried, or even considered, to have two Pyrex pressure plates to hold the film flat when the film is stationary, then to let up on the pressure when the film is being pulled down?—GEORGE L. BAKER, Wilmington, California.

THE suggested application of glass aperture pressure plates for motion-picture projectors revives the perennial film-buckling problem and at once brings to mind the use of glass pressure plates in the gates of 35-mm filmstrip projectors. Each frame is exposed in a filmstrip projector for a considerable length of time, however, and no pressure-release mechanism is ordinarily employed to separate the glass plates during frame shifts.

The use of pressure-plate aperture glasses in filmstrip projectors is necessary to avoid the loss of focus which would result from the rather severe buckling of unsupported film. Even when the light source is only a tungsten bulb of a few hundred watts rating, enough heat is absorbed by the film emulsion after a few seconds exposure to "snap" it out of focus.

Similar buckling "excursions" of film take place in a powerful motion-picture projector in a mere fraction of a second.

Film Width Big Factor

The width of the film is undeniably a very significant factor in film buckling. To be specific, it is the *unsupported* width of film between the gate runners that is important. Now, all films from 8 to 70 millimeters in width have the same thickness (approximately 0.006 inch for triacetate stock), hence the susceptibility to buckling is practically a function of the unsupported width of the film divided by its thickness. We can therefore calculate the relative "buckle susceptibilities" of the various film sizes:

FILM WIDTH	"UNSUPPORTED" WIDTH	REL. BUCKLE SUSCEPTIBILITY
8 mm	0.2 inch	33
16 mm	0.4 inch	67
35 mm	1.0 inch	167
70 mm	2.0 inch	333

It can be seen from the above that the buckling susceptibility of 8-mm film is negligible, while that of 16-mm film is less than half (40%) of the tendency of standard 35-mm film to buckle under the impact of heat. On the other hand, the 70-mm film used in the Todd-AO process has fully twice the tendency of 35-mm film to buckle, thermal and mechanical conditions remaining the same.

It should be noted that the "unsupported width" in large-frame horizontal VistaVision film is exactly the same as in regular 35-mm film, hence the superiority of horizontal VistaVision over 70-mm Todd-AO as regards film flutter and buckling.

Plate Use Impractical

The suggested use of glass pressure plates in the gate of a wide-film motion-picture projector to prevent annoying buckling is unfortunately impractical.

In the first place, the glass plates would retain and transfer to the film a considerable amount of heat. The film emulsion might thereby be softened or even scorched. Second, the presence of the plates would prevent air-cooling of the film at the aperture. Third, the glass surfaces would quickly collect oil and dust which would show up on the screen, marring the picture. Fourth, the vibratory motion of the plates, necessary for releasing the film during the intermittent pulldowns to prevent scratching, would create an intolerable amount of noise.

Other means are available for minimizing film buckling, though no known method can prevent it completely. These are the pulsed air blast described by Willy Borberg in the October 1952 issue of IP (page 14 *et seq.*), and the curved gate discussed in Borberg's later studies titled "Gate and Shutter Characteristics" in IP for June 1958 (p. 13 *et seq.*), and July 1958 (p. 10 *et seq.*).

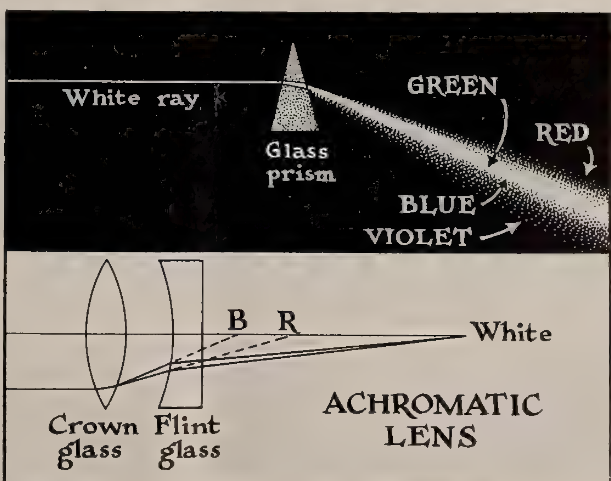
The modulated air blast is capable of reducing film buckle to about 40% of normal, on the average; but the effectiveness of this method is often unpredictably capricious and disappointing. Completely dependable, however, is the curved film gate (available for Simplex projectors) which reduces buckle to about 75% of normal. The curved gate has the added advantage of equalizing focus across the frame from one side to the other.

At arc currents in the 60—80 ampere range, *and with conventional straight film gates*, 35-mm triacetate film exhibits an in-and-out of focus excursion distance of from 0.020 to 0.030 of an inch measured at the center of the frame over the aperture. Buckling is usually more severe at appreciably higher arc currents, especially if neither heat filters nor forced air-cooling of the film is employed.

Actual tests prove that a curved gate reduces 0.030 inch of buckle, which would normally occur in a straight gate when arc current is about 80 amps, to approximately 0.023 of an inch. Even so, and under identical conditions of heat and gate curvature, 70-mm film will have a buckle excursion distance in the neighborhood of 0.060 inch. This is admittedly extreme, and it has the bad effect of forcing the large frames into a "pincushion" shape which destroys sharp focus toward the screen sides.

The writer's conclusion: 35 millimeters represent the *maximum practical film width* for motion-picture *projection* prints. Todd-AO 70-mm prints evidence no advantages whatever in regard to image clarity.

The What, Why and How of Chromatic Aberration



Here is expressed graphically the cause and correction of chromatic aberration. Note that a single ray of white light passed through a glass prism is bent toward the *thicker* part of the prism both when entering the glass and when leaving it. Of course, the "shorter" violet and blue rays are refracted more than the "longer" red rays.

In the SPOTLIGHT

LAS VEGAS TECHNICIANS

Graham T. Bennett, member and former president of Las Vegas, Nev., IA Local 720, shown at the control console of the lighting board (made to his specifications by Century and Izenour) at the fabulous Tropicana Club.

Harold Preuss and Morris Pitcher, members IA Local 720, who nightly deliver the lumens for the stage show at the Tropicana Club.

Not Quite the Millenium—But Almost

COMES now the admission by motion picture theatre owners that the process of presenting properly the only merchandise they have to sell—the visual-audio conglomerate *on the screen* —has suffered severely in terms of quality through *their own* laxity in terms of broken-down equipment, scrimping on replacement parts, and general overall indifference to that which was the *only* reason for collecting an admission price.

This GOSPEL has been preached by IP for 27 years in print and orally by its representatives on the far-flung frontiers of national and sectional meetings. The response thereto from exhibitors was muted.

Joint IA-TOA Effort Solicited

Lately, the energetic head of the Theatre Owners of America, an upstanding lineal descendant of Athens by the name of George Kerasotes, dispatched letters to the manufacturers, the supply dealers, the national service organizations, and—wondrous to behold—the IATSE in which he pleaded for a *joint* effort to eradicate the shortcomings uncovered by the all-IA team of specialists which recently surveyed several hundred theatres in all categories and found therein presentation failings which actually distracted the audience from the visual sequence, the accompanying sound.

Significantly, there was reported in IP, last month (p. 3) the statement by Dr. William Kelley of the Motion Picture Research Council that "the cost of this field study could no longer be borne by the producers alone"—an admission that the theatre owners really weren't concerned with the *quality* of their screen presentations.

The reaction of the IATSE was immediate and positive, to the effect that what was now being proposed was a replica in detail of what its affiliated Local Unions had been doing *on their own,* often after midnight when the theatres closed, for so many years back. Of course, the IA would go along with the suggested program—enthusiastically.

The craft has been struggling for the past ten years with more variations of the projection process than a three-headed cat in a fishstore; and if the courageous Greek from the Mid-West can jell these efforts into a coordinated whole, he will have gained the all-out support of the organized craft. When do we start?

• Settlement of the long-drawn-out negotiations for a new wage pact for the 21 IA craft units active in West Coast studio production, involving both the theatrical and TV forces, was achieved on Friday, January 30, just a few hours before the approach of the contract deadline at midnight.

The new two-year pact provides for a flat 21-cents-an-hour wage increase for all crafts, and while somewhat below the 15% increase asked originally by the IA, provided for some 15,000 workers improvements in the health and welfare plans now in existence. The new termer allows for overtime as well as straight-time allowances. Also, the life insurance proviso is raised from \$1000 to \$2500.

Settlement marked the return of the

THEN AND NOW: INDICATING THAT THERE IS NO SUBSTITUTE FOR EXPERIENCE

The boy in the left photo is the kid who worked as an "operator" at the Post Theatre in Green Bay, Wis. Date: 1908. Today, having overcome the travail of technological developments (don't mention varying aperture plates) he is a projectionist at the Music Box, Seattle, Wash. (IA Local 154). Name: Harry Miller.

studio-craft agreement to the traditional two-year pact agreement, the sole exception having been the now expired pact which ran for three years as a condition of studio workers going on a five-day week work agreement.

• Officers of the 25-30 Club of New York as installed at the gala party held in the ballroom of the Empire Hotel, that city, on January 8 last: president, Morris J. Wolheim; vice-president, Ben Norton; recording-secretary, Morris Kalpholz; financial secretary, Ben Stern; sgt.-at-arms, Nat Staruss; trustees: Julie Wetzler, Charley Schneider, and Louis Locker.

Among those present were Allen Smith, National Theatre Supply; Paul Reis, National Carbon; from Altec: the Georges Evans and Brown; Walter Knopf, Secretary, Local 253, Rochester, N.Y.; M. D. ("Obie") O'Brien, former projection chief of Loew's Theatres, and his successor, Johnny Kohler; Ben Olevsky, chief of Radio City Music Hall; Marty Bahn, Camera Equipment Co.; Eddie Lachman, boss of Lorraine Carbons; Al DeTitta, Local 384, New Jersey; Johnny Rollman, chief of Todd-AO at the Rivoli Theatre, N. Y. City, and Jim Finn, of IP.

IA ELECTIONS

LOCAL 105, LONDON, ONT., CANADA

H. J. Allaster, *pres.;* M. Rehder, *vice-pres.;* C. W. Mills, *sec.-treas.;* Wm. Shaw, *rec. sec.;* J. McCully, *bus. rep.;* J. McLeish, *sgt.-at-arms;* J. McLeish, H. McLean, *executive board;* W. Hewitt, McLeish, W. Drennan, *trustees;* C. Mills, H. Allaster, W. Shaw, *examining board;* McLeish, Shaw, *auditors.*

LOCAL 253, ROCHESTER, N. Y.

Fred Boukhout, *pres.;* Burt Blackford, *vice-pres.;* Frank Placerean, *fin. sec.* and *treas.;* Walter Knopf, *rec. sec.;* Frank Coniglio, *bus. rep.;* Alfred Hill, *sgt.-at-arms;* Louis Levin, Louis Goler, Joseph Pandina, Charles Tibbetts, *executive board;* Harry Levy, L. Goler, Abe Orden, *trustees regular funds;* Fred Hart, F. Placerean, Ernest Henley, *trustees welfare funds;* Mark Harloff, *treas. welfare funds;* Joseph Vecchio, Sr., A. Orden, F. Coniglio, *Central Trades delegates;* J. Vecchio, Sr., *Union Label Trades delegate.*

LOCAL 273, NEW HAVEN, CONN.

Anthony Basillicato, *pres.;* Benjamin Estra, *vice-pres.;* John Mongillo, *sec.;* Ernest DeBross, *bus. rep.;* James T. Melilo, *executive board.*

LOCAL 465, JOPLIN, MO.

W. E. Morgan, *pres.;* W. R. Houser, *vice-pres.;* R. L. Long, *sec.-treas.;* G. W. Wilson, *bus. rep.;* L. W. Kilgore, *sgt.-at-arms.*

P. A. McGUIRE

1875-1959

P. A. McGuire, for 30 years advertising manager and public relations counsel for, first, Nicholas Power Company and subsequently for the firm which absorbed this enterprise, International Projector Corporation, died on January 20 at Amityville, Long Island, N. Y. His age was 84.

"Mac," as he was affectionately addressed by thousands in the projection field with which he was intimately identified, was a member of the famous Seventh Regiment of New York City, a member of the Masonic order, an overseas worker for the YMCA in World War I, and active in many civic and fraternal organizations.

He leaves his wife, Flora; two daughters, Kathryn and Mrs. Leland Grey; a son John, and two brothers.

VERY much the poorer today is the projection craft through the passing of P. A. McGuire. His unswerving devotion to and active efforts in behalf of the craft and its profession has not had an equivalent. Nothing set down here could contribute by so much as a milimeter to his stature as an earnest, courageous and at all times a sympathetic striver for the other fellow's welfare—whether at work, at home, or in times of stress.

"P. A." was "Mac," and this equation is a never-changing constant. Coiner of the slogan "Better Projection Pays," P. A. fought the good war in the interest of the craft world-wide. Mute testimony to the accuracy of this statement is the fact that within ten days he received honorary gold life-membership cards in IA units ranging from Toronto, Canada to Texas.

"Mac" always had a "project" in hand for the benefit of projection generally and the craft in particular. It was as nothing for him to organize and work hard at the business of the Projection Advisory Council, which the Academy recognized as the representative projectionist body, and then turn about and stage a "Motion Picture Projection Day" at the World's Fair in New York in 1939. His multiple other efforts in behalf of the craft were mere extensions of these major undertakings.

But it is as a man, an individual, a warm human being that he should be remembered here. Not endowed with large-scale physical proportions, "Mac" gave ground to nobody in the physical sense, and he dwarfed most of us in the mental area.

It was this latter quality that endeared "Mac" to his thousands of craft friends. He was warm-hearted in the extreme—this statement includes all the humanities—and he was a true friend, a solace to and an uplifter of the spirit for all with whom he came in contact.

"Mac" won't be with us physically in the future; but it will require a truly cataclysmic event to erase from our minds the memory of the man and his many good deeds.—J. J. F.

• Still another honor has accrued to Morris J. Rotker, past-president of the 25-30 club of New York, and tireless worker in the projectionist vineyard. Already a member of the School Board in Bronx County, N. Y., he has just been appointed a member of the Mayor's Committee on Scholastic Achievement for the City of New York. This group considers and votes upon scholarships in the area of higher learning.

Morris' efforts in behalf of those who ask for and show due diligence for advanced educational training in N. Y. City have won him many honors in this field.

OBITUARIES

Local 162, San Francisco, Calif., reports the loss of two members—ORVILLE G. ROUSH and JUSTIN PAUL WILLIAMSON—who died last month within 24 hours of each other.

Orville Roush, 79 on his last birthday, worked at the New Mission Theatre in San Francisco for the past 30 years. Justin Williamson, 64, was apparently recovering from a heart attack when he was stricken with a fatal siege of pneumonia. He worked as projectionist and newsreel editor at the Telenews Theatre in S. F. since the theatre opened some twenty-odd years ago.

• • •

BOWYER, SR., HENRY, 83, member of Toronto Local 173, died December 7. A member of the Local for 41 years, he recently retired from his work as projectionist and was on a $75 per month pension from his employer.

• • •

CARTER, ROSS P., 63, member of Local 378, Wichita Falls, Texas, and projectionist at the Trans-Texas Strand Theatre there, died suddenly last month.

• • •

HEDGES, CHARLES I., 68, member of Local 414, Wichita, Kansas, died suddenly on January 15. He recently retired as projectionist at the Fox Uptown Theatre in Wichita, where he had been employed for 20 years. He made his home since his retirement in Denison, Texas.

AUDIO - VISUAL
EDUCATIONAL • INDUSTRIAL • COMMERCIAL

Tips on A-V Equipment Procedures

By JOSEPH F. HOLT

MANY cases of annoying "hum" in the sound of 16-mm projectors may be traced to aged filter condensers in the voltage supply to the exciter lamp. Many, if not most, projectors make use of a small oscillator which provides AC voltage at a frequency above the audible limit of the human ear, i.e., above 20 kilocycles or so. If the filter condensers are defective, such a condition may be readily determined by placing an opaque card over the sound scanning point. If the hum is originating in the exciter oscillator, this step will readily indicate such to be the case.

Correction involves replacement of the appropriate condenser by a qualified person, which usually means the service department of a distributor.

WE RECENTLY had occasion to provide a sound channel for a 16-mm program in a large hall being used for an emergency program on a one-time basis. The arrangement of the hall and seating was such that amplifier-to-speaker cable layout was lengthy and time-consuming. The solution in this case was found in matching the projector amplifier to a wireless oscillator which uses the standard broadcast AM band for transmission of signals within one room.

At the screen end, an AM tuner was used to feed two power speakers, and the results were acceptable. Perhaps some of our readers may want to make use of this arrangement; they should encounter little difficulty in doing so.

Proving just once again the truth of the maxim, "Where there's a will there's a way."

MOST MODERN A-V equipment is fabricated of the very best components which will resist the invasion of moisture. Accidents do happen, however; and if apparati is inadvertently subjected to damp conditions, it is possible to dry out the parts by judicious use of the small infrared lamps available almost everywhere. These lamps may be mounted above amplifiers while the chassis is inverted, or they may profitably be placed at the side of the chassis with the underside exposed to the rays.

It is necessary to exercise caution in the application of heat, and something in the region of 170° F. at the chassis will produce effective drying without causing the wax seals of certain condensers to ooze out. If the wax should flow, incidentally, it is good procedure to replace that affected part in order to avoid future moisture problems.

DOESN'T IT make sense to check after each run of film to see if any damage has occurred? It may not always be a projectionist error, and by detecting equipment conditions which result in film damage after the first occurrence, it follows that the library will be preserved longer and in better condition. Inspection should be performed meticulously by a qualified person, and appropriate records should be kept.

SOME SOUND PROJECTOR USERS encounter serious trouble with ringing noises which seem to persist in spite of normal efforts to locate and remove them. Most people are familiar with the fact that the input tubes of many amplifiers operate at extremely "high gain" conditions and for this reason may introduce bell-like tones when subjected to shock of mechanical vibration.

It is not generally recognized, however, that the exciter lamp and photocell of the projector may also be the source of ringing disturbances.

To detect the source of such annoyances, turn on the projector and adjust the sound volume control to the normal loudness setting. If ringing noises are heard while the exciter is tapped with the eraser end of a pencil, insert an ordinary calling card at the point where film is scanned for sound. This is done in order to block the light path and to isolate the exciter from the photocell.

If the noise is not present with the card in position and the exciter subjected to tapping, replacement of the exciter should cure the trouble. However, even a new lamp may exhibit microphonic characteristics.

Noisy photocells may "ping" when any part of the projector is tapped, but will display much louder noises when the cell glass is topped. Comparison with photocells known to provide quiet operation will eliminate faulty cells.

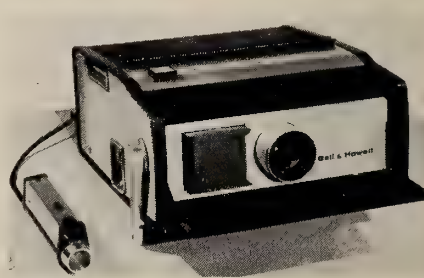
Technical Data Indispensable

Recently I was called into consultation by a church which had booked a 16-mm CinemaScope print. The anamorphic sent to them arrived with a mounting bracket—but without a single word of instruction! This sort of thing, which occurs regularly and not only in the church area, points up once more the urgent necessity for a source of reliable technical information and guidance.—JOSEPH F. HOLT.

B&H "Explorer" Projector

AS TRIM as a portable radio or typewriter are the new Explorer completely automatic slide projectors by Bell & Howell. Handy carrying bar becomes basic tilt mechanism and front and rear panels swing down for immediate projection. There is no case or cover to remove. This Explorer 754Y, 500-watt model features exclusive Filmovara zoom lens which fills 40-inch screen from as close as 8½ feet or as far as 11 feet without moving projector. A built-in timer for automatic slide showing operates in time sequences from 8 seconds to a minute.

The remote control unit at left advances or reverses slides, the first remote with this feature, and doubles as an illuminated pointer when aimed at the screen. The projector is fashioned in handsome black vinyl and features scuff-proof side rails that will not mar furniture.



B&H "Explorer" automatic slide projector.

Audio-Visual Education: A New Era Begins

The editor of IP was privileged to hear at the opening get-together luncheon of the convention of the Society of Motion Picture and Television Engineers an address by Maurice B. Mitchell, president of Encyclopaedia Britannica Films, Inc. Appended is the first of two articles which, severely edited, are so informative, challenging and inspiring as to provide not only a "lift" for A-V personnel but excellent ammunition for those of limited vision who, controlling budgets, fail to grasp the full significance of audio-visual programs as a magnificent teaching tool.

TEACHERS and school officials of our country remind us that they lack vital resources. My associates at Massachusetts Institute of Technology tell me that in the 28,000 high schools of the United States today there are probably no more than 11,000 adequately prepared physics teachers, and no more than 3,000 of these are first-rate. We have stepped across the threshold of a technological revolution. There is no road back. Every businessman knows that to preserve and advance the technology he must find trained manpower. His only resources are our schools, colleges and universities.

The Communication Revolution

Another revolution of our times is the communications revolution which will change the classroom of tomorrow. The teacher faces an almost insurmountable problem in communicating to different levels of perception. In films giving all students experiences in common, the teacher has found for the first time a device for establishing this precious uniform background.

Films make unique contributions to learning. (*A child in Cleveland can sit down in the home of a Chinese child, etc.*) They take man out of his environment, back in time and into time compressed and expanded, into the most immense or minute spaces and inside man or matter, and to observe energy.

The First Complete Course

Our primary concept in the development of audio-visual techniques was to help teachers overcome old limitations. In recent months we have gone far beyond that.

Working with the National Academy of Sciences in response to the shortage of physics teachers, we completed and delivered to the schools an introductory course in physics for senior high school or freshman college students. It is the first complete course in the American curriculum ever recorded entirely on sound motion picture film.

The NAS told us that the best qualified teacher in the field of physics teaching was Harvey White of the Universtiy of California. Under merciless white-hot lights and the remorseless stares of motion-picture and TV cameras, he taught the classic course in introductory physics for 162 consecutive days. With its 1¾ million feet, it may be the biggest single sound motion-picture project ever undertaken. Closed-circuit TV brought the course to experimental groups of students. Dr. White's course has been used in 400 American schools during the last school year—often in classrooms with no teachers.

At the end of the first semester, all 1587 students took an achievement test in physics. Results: students taught by the faculty scored 66% and those taught by the film alone scored 72.2%.

In Cummings, Georgia, an eighth-

Genarco Slide-Changers Set New High Standards

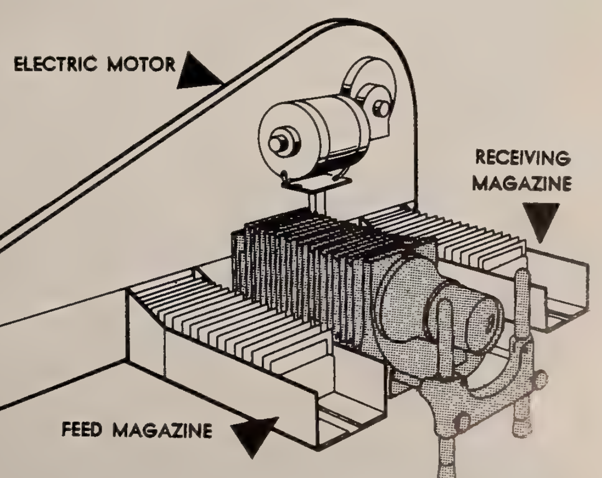
EXPERT IN THE professional slide-projector and spotlight field, Genarco, Inc., has lately adapted the professional touch for the school and industrial audio-visual fields. Applying the same technique requisite for the "pro" field, ranging from giant 60-feet high outdoor expositions requiring precise optical systems and a never-failing source of light, Genarco has now applied this know-how to the reduced, and therefore more exacting, images required for the more intimate approach which exists on the campus. For example:

Mounting Electric Slide Changers on Existing Slide Projectors: Slide projectors for 3¼- x 4-inch slides are used in large quantities in museums, colleges, universities, TV studios and, generally speaking, whenever large and very bright images must be projected. When 2- x 2-inch slides are used, or 35-mm slides, the amount of light that the slide can transmit without overheating is limited (generally) to a 750-watt incandescent lamp.

When very large images must be projected, the magnification required when a 2- x 2-inch slide is used is such that the quality of the still picture is not as good as that obtainable from the image of a 3¼- x 4-inch transparency.

Until now most of the 3¼- x 4-inch slide projectors were equipped with manually-operated slide changers. Genarco's Electric Slide Changer, Model 6800, with the 70-slide magazine enables the operator to change the slides by push-button. For special effects, one could even operate two or three slide projectors, fade the images projected by one unit into the image of another, and get all kinds of striking screen results unobtainable with a manual slide changer.

Every user of 3¼- x 4-inch slide projectors should investigate the Genarco Electric Slide Changer. Professional operators in the A-V field have always recognized and profited by the utter reliability of Genarco units.



Detail of the Genarco electric slide-changer, which accommodates—with remote, push-button control—70 slides of either 3¼- or 4-inch diameter.

grade boy has been placed in a senior class at Forsythe County High School to study physics by film. He is scoring in the top third of the class. This is of interest to those who have noted that Russian children begin physics in the sixth grade.

The Vital Ten Years Ahead

We now have a team at M.I.T. who propose doing weird and wonderful things to the classical or traditional American high school physics curriculum represented by the course Dr. White put on film. It is their contention that physics, as we now teach it, has been outmoded since 1926!

This team of 90 physicists, exploring the far frontiers of this subject and talking a language few people can understand, literally tore the old physics course out by the roots. Their textbook is unlike anything physics teachers have ever seen. The laboratory equipment is made from Erector sets, old lumber, soda straws, coat checks, and used frozen orange juice cans—to name just a few of their improvisations.

They would like to see the student make his apparatus with his own hands in his own home to enjoy what Robert Oppenheimer calls "personal experience" in the discovery of scientific principles. We are shooting 70 films which have no precedent in the entire audio-visual field, 70 new concepts fresh out of an atomic energy-oriented world.

Half Enough Not Good Enough

Yet, this isn't good enough. We are only doing in the audio-visual field what education has always done—taking the *leavings* of American technological development. The TV set in the classroom is at best an adaptation of the set in the living room. It is not designed for classroom use; it does not function ideally as a classroom instrument.

The sound motion-picture projector we use is a shrunken-down version of the big projector designed for motion-picture theaters. It hasn't radically changed in the last quarter-century. It is still a great, fat, hot, wheezing device which terrifies most school teachers of either sex.

We are still making motion pictures on the same delicate, fragile acetate we made them on in the beginning, with its precision-punched sprocket holes and the delicate layers of chemicals on the top. We put the film in the can and it shrinks and stretches and liquefies and does all sorts of strange and mysterious things. It is still hand-processed in some kind of witch's brew in a darkroom.

[ED.'s NOTE: In the next and concluding installment Mr. Mitchell will present in detail his concept of the "Classroom of Tomorrow" as it will apply, he confidently expects, to the use of audio-visual materials and applicative procedures.]

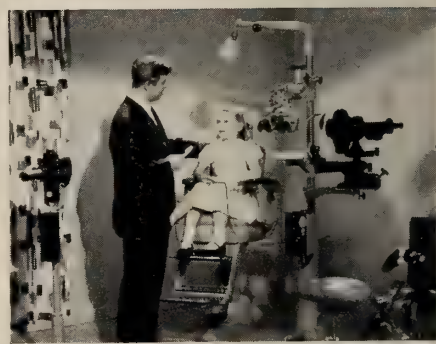
Two Fine B&L A-V Program Aids

BY AND large, it is left to the school to detect unseen weaknesses in vision and report them to parents —who then will act, *if* they have been sufficiently awakened to the importance of visual care for growing, learning children. This is evidently a big "if."

Parental Interest Assured

Bausch & Lomb Optical Co.'s substantial contribution to the solution of this problem is "Report Card on Vision," a 16-mm color film professionally produced to banish the "ifs" from the eye-care program in schools. The film follows the case history of "Nancy," a nine-year-old with typical visual problems, from her first difficulties at school through detection by vision screening, consequent refraction and fitting with new glasses, to the new world of better grades and better personal adjustment through good vision.

For the benefit of solicitous parents



Nancy's report card on vision results in a professional examination.

Nancy's visual difficulty is discovered by the school nurse.

it illustrates the step-by-step process of vision care, and awakens them to demands on vision that will be made upon their children in the world of tomorrow. Nancy, the leading lady with her cute new Tinker Bell frame, does much to overcome the reluctance many parents feel to have their children wear glasses.

The film also serves to introduce the B&L School Vision Tester to school audiences. Board members, school officials, and local health authorities will quickly note the compactness, facility and precision of this new instrument, which fits so neatly into the visual care programs of large modern school systems.

School planners and administrators will see that no special testing room or 20-foot alley is necessary. The school or the PTA can in turn use the film to show the public how the screening program works, with the Vision Tester.

Acquisition Simple, Speedy

"Report Card on Vision," in full color, runs for 15 minutes. It is available for loan or purchase from your nearest B&L Instrument Dealer. An accompanying instruction booklet makes it easy to set up the showing, and a script is provided for an informative introductory talk on the problems and statistics relating to school vision.

A new B&L sales policy will make it easier for a school to learn about and purchase the School Vision Tester. Already having official approval in several states (New York and Michigan,

Novel TSI Leasing Service; 16-mm Projector Booklet

AN EXPANDED leasing plan to include all models of motion picture projectors has been announced. TSI Leasing Inc., 30,865 Five Mile Rd., Livonia, Mich., and the new plan allows for rental of standard projectors, projectors with a built-in, television-type screen, and repeater magazine projectors for continuous film showings. If a purchase is made later, allowance will be made for rental money already paid.

The leasing field has seen marked growth in the past year, brought about chiefly by film-users who want a temporary increase in their volume of showings.

"A 16-mm projector-selector in print" is the concept of a new TSI folder. Starting with conventional darkened-room projection-on-a-screen, it pictures the development into models with a TV-type screen added for daylight showings; thence to repeater magazine models for continuous film showings. How industry and schools are now making use of these projector-types is illustrated.

for example), the instrument is now being offered on a 30-day trial basis. Upon written request, the instrument—complete with accessories and manual—is shipped to any interested school, and may be returned if not found completely satisfactory after the 30-day trial.

* * *

Victor 25 Ann'y Contest on Old Sound-Film Units

TEN PROJECTORS made in 1933 which still are in good condition and operated steadily by their owners have been selected by Victor Animatograph Corp. from more than 1000 entries as the oldest Victor soundfilm units still in use. The entries marking the 25th anniversary of the first sound-film projector, came from all over the United States and from seven foreign countries.

Fifth Unit Made the Oldest

The oldest projector located was serial number 12,005, the fifth sound-film mechanism made by Victor. "We were happy to find so many of these early models providing efficient service," said Hy Schwartz. president of Victor. "Practically all entries stressed the ruggedness and durability of the unit and the value of the Victor Safety Trips."

Each of the ten contest winners will receive in exchange for their original projector a new Victor Assembly projector, Model 65/10. Victor, a subsidiary of Kalart Corp., is expanding its program of research in optics and sound engineering at its plant in Plainville, Conn.

* * *

G.E. "Radiation" Program

Some 1850 radiation workers in 72 departments of General Electric Co. have sustained an average annual whole-body exposure of only 0.22 rads.* In so diversified and decentralized a company as G.E., these 72 departments act in many ways like separate industrial firms. They are located in 40 cities in 20 different states.

Employees Actually Engaged

In addition to 1850 employees actually engaged in radiation work, some 4500 more work in the vicinity of radiation sources while total employment equals 112,000. About 22% of the installations have less than 4 persons actually doing radiation work, but almost half have more than 40 persons working in the vicinity of such sources.

* A rad is a measure of the absorbed dose of any nuclear radiation.

More A-V Data—Next Page

"Stereo": What it is and What it Does

The second in a series of definitive articles on stereophonic sound, as prepared by the Fairchild Recording Equipment Corp., 10-40 45th Ave., Long Island City, New York.

IN ITS present state of development stereo sound is originally recorded in two, three or more channels on as many separate tape tracks (many major companies have been recording this way for several years and have a huge library of stereo master recordings). For the final recording, these channels are "mixed" and then put on two separate channels on one tape or, now, on a stereo disc. The playback is then kept entirely separate just as in the "binaural" system, but the final sound outlet is from two loudspeakers instead of from two earphones.

The difference between listening to two loudspeakers as compared with listening through two headphones is that the observer does not have complete separation of the two channels with two loudspeakers. That is, his left ear will hear *some* of the sound coming out of the right speaker, and his right ear will hear *some* of the sound coming out of the left speaker, because of reflections from the walls of the room where he is listening.

"Live Presence" Reproduction

Since stereo reproduction is therefore less "pure" than binaural (although infinitely more practical and acceptable) it requires a little more artistry in the recording process, and this is just what the recording engineer must apply. So, he balances the various original channels in such a way that *when played back through two loudspeakers,* the sound will be most natural. This is not so hard to do, since he has available a playback system much like the one used in schools and homes.

Perhaps it will now be clear why with stereo the effect is more like putting the orchestra into *your* area, since the acoustics will have some influence on the sound.

Thus far we have found that stereo requires two microphones and two separate recordings, and also two separate amplifying systems and two independent loudspeakers. It has the effect of eliminating the "keyhole effect" and of "opening up" the music so that the orchestra or the artist is brought right into the listening area, instead of having to hear it through a small opening, or even two small openings. Previously this has been possible only on tape recorders or by using both an FM and AM radio receiver simultaneously.* Now what about stereo discs?

The advantages of two-channel sound have been recognized for many years, but it has always seemed very difficult to achieve this kind of double recording without great complexity and expense. Tape recording supplied a relatively easy method of providing the purchaser two independent recordings (which is what two-channel recording amounts to) but there were many drawbacks.

Expense Factor With Tape

The principal disadvantage was, of course, expense, because a tape recording itself costs two to three times as much as an equally good LP disc recording. Also, many people do not own tape recording machines (although many own phonograph equipment) and it is, therefore, necessary to buy a fairly expensive piece of equipment in order to use a stereo tape.

Although it may not be inherently necessary, it seems to be true at present that a *good* tape playback machine is rather more expensive to buy than equally good disc equipment.

Another very practical disadvantage of tape is that in order to play back a tape with good quality, it is necessary to have the playback head aligned in the exact plane relative to the tape as was the original recording head. This is difficult enough even when playing back a one-track recording on the machine on which it was originally made; but when a dual-track recording is played back on another machine, this misalignment problem can be quite serious. It is something like the effect that would be obtained in playing a phonograph record with a worn needle, or one too large or too small for the groove (except that tape head misalignment will not damage the tape recording, naturally).

Re-Recording Quality Loss

Still more problems are added when the original tape is not used but instead a re-recording, which naturally is exactly what a commercial tape recording is. In other words, each time the tape is passed through another duplicating process, the deterioration of sound because of head misalignment (and other factors, as well) tends to become more pronounced.

Stated another way, as of today disc lends itself much more gracefully to mass production of quality.

Since Fairchild makes both tape and disc recording equipment, as well as professional and home, or hi-fi playback equipment, it has no interest whatever in "talking down" tape systems. In fact, Fairchild developed and manufactured some of the first (and still among the best) tape recording machines for use by recording studios. Nevertheless, there are disadvantages in tape, as there are in all systems for doing anything of a practical nature.

Another serious drawback to the use of tape is the difficulty of threading and handling it. No matter how well things are worked out, there is always the danger of tape spillage. Even if this were not so, the great disadvantage of not being able to start immediately at any desired point is a very real one.

[TO BE CONTINUED]

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* FREQUENCY MODULATION (FM)—A method of radio broadcasting in which the broadcast waves change in *length* and their *strength* remains constant.

AMPLITUDE MODULATION (AM) — The present standard method of broadcasting, in which the broadcast waves *change* in strength but the wave-length remains *unchanged.*

WHAT FM DOES—Eliminates static, noise of electrical appliances and other disturbances that interfere with reception on AM radio receivers. It also permits reception of the entire range of sound *audible* to the human ear.

Content Enhanced by Technique

The article beginning on page 5 of this issue is of particular import to those who appreciate the value of *manner* of presentation as well as *content* of a particular subject. We at IP feel that this is one of the most definitive articles ever published on presentation technique.

* * *

University Degree by TV?

ENVISAGING A PLAN under which state and regional TV stations would be linked in a nation-wide system that could cost $800 millions, John Ivey, executive vice-president of New York University, told the U. S. Senate Commerce Committee that such maximum use of educational TV could make it possible to get a university degree without attending school. Mr. Ivey plumped hard for a "much larger" sum in Federal aid for educational TV than the $1 million ticketed.

Lecture System Predominate

The TV student would need help from suburban discussion leaders and bookmobiles, he suggested, estimating that 85% of undergraduate instruction was carried out by the lecture system, which could be duplicated on tape. Mr. Ivey said the TV system would be superior because the student could hear top experts in each field. He said it could help solve the teacher shortage.

Silicone—Treated Cloth?

By JAMES J. FINN

SILICONE-TREATED cloths represented as having a wide variety of useful applications in the projection field have been the topic of numerous letters received recently by IP, so much so that IP feels impelled to express its opinion as to the various uses of this product suggested by the manufacturers thereof.

IP absolutely disapproves of the use of silicones on motion-picture film, lenses and phonograph records. However, even though silicones leave a mottle on film, they may possibly be used with benefit on filmstrips because the film remains in contact with hot glass pressure plates during projection. Use of a silicone cloth in this application may prevent sticking and emulsion damage.

It should be obvious that both the filmstrips and the glass pressure plates will require frequent cleaning when silicones are used. In any event, IP is not sure that it should wish to recommend a silicone cloth even for this purpose.

Use of silicones on films of any kind that may in future be duplicated by contact printing is harmful. Raw stock is mottled and fogged by silicones, according to Eastman Kodak Co.

IP has had tests made of such cloths on film, phonograph records, the film gates of projectors employing high-intensity arcs, and various other units in projection rooms, in addition to the treatment of film under special conditions. These cloths cannot harm, nor much help, release prints unless too much moisture is applied to the cloth, and it may be useful to prevent, or minimize, the "sticking" of "green" prints. However, if the film is not wiped in a *continuous* manner, there is a tendency for such cloth to leave an oily streak or mottle on the surface.

Use on Lenses Unthinkable

Under no circumstances, however, should silicone-treated cloth be used on raw stock or on negative or master-positive printing films.

IMPORTANT TO PROJECTIONISTS: *The use of silicone cloth on camera or projection lenses is unthinkable.* All lens manufacturers warn against such usage on coated lenses for the simple reason that a layer of silicone or any other kind of grease or oil interferes with the proper optical functioning of the magnesium fluoride anti-reflection coating. Such coatings are designed to work efficiently with glass on one side of them and air on the other.

The use of silicone cloth neither guards against the brittleness of film nor fading of the photographic image. The statement that the cloth adds "depth, brilliance to color or black-and-white-film" is unfounded. Silicones are incapable of acting as intensifiers or reducers, though it may be assumed that the removal of dirt from the film improves the quality of the image. Photo filters should not be treated with silicones, especially if the filters are anti-reflection coated.

Not a Dust Resistant

A silicone coating on film or phonograph records does not prevent the collection of dust. In fact, dust adheres more readily to silicone-treated film than to clean, dry, unlubricated film. The

Are You Moving?

If so, please notify us one month in advance. The Post Office does not forward magazines. To avoid delay, please cooperate by sending us both your *new* and *old* address.

film of silicones applied by the cloth is not "tough" but very similar to a film of ordinary grease or heavy oil. Silicones spread to a greater extent than ordinary greases, however, and feel "dry," rather than oily, because of their powerful moisture-repellent properties.

Probable Useful Application

A silicone film is removed more readily by film-cleaning liquids than is an oil film. Actually, the ease with which silicones are dissolved by hydrocarbon oils and greases renders them very impermanent as movie-film coatings. Ordinarily, release prints come in contact with oil used for lubricating projectors. The presence of oil removes silicones with amazing rapidity.

It seems that the most useful application of the cloth lies in the direction of lubricating the sprocket-hole *edges* of green prints, waxed or unwaxed. A silicone coating on the film margins of new prints (emulsion-side only) would materially reduce the likelihood of "sticking" in the projection gate, and is superior to the use of ordinary oil because it would not "spot" the picture and soundtrack areas to an appreciable extent.

Unfortunately, however, such cloths do not readily lend themselves to the coating of the perforation margins only. Some kind of simple applicator device would be a minimum requirement for this job.

Lubrication of gate runners and tension-pad surfaces with silicone may possibly be helpful when running green prints, especially unwaxed ones; but the silicones would undoubtedly vanish after the passage of 50 to 75 feet of film, and be removed almost instantly by a few feet of oily film.

Victoria X Projector in U. S. Distribution Bow

Another entry in the wide-film projector market in the United States is the Italian Victoria X "all-purpose" projector and sound system suitable for showing either 35- or 70-mm prints. The system will be distributed exclusively by Cinematograph International, Inc., 341 West 44th St., New York City, which is headed by George Hornstein, veteran equipment dealer.

The Victoria X will be included in a "package" deal which will comprise the entire reproduction system from projection room to screen, including full engineering advice and servicing. Cinematograph, Inc., also distributes Ampex magnetic and optical sound systems.

Complete Flexibility Assured

The Victoria X approximates the Philips dual-purpose projector, with its sprockets having four rows of teeth, a three-lens turret and a curved gate. Completely flexible, the Victoria X may be used in combination with other makes of American sound systems and arc-lamps. It may be used for all film processes, including Todd-AO 65-70 mm. six-channel magnetic film, and for all aspect ratios of 35-mm film with three- or four-track magnetic sound for CinemaScope, single-track mixed magnetic sound, and single-track optical sound. The change from 70-mm to 35-mm film requires less than a minute.

The Victoria X is used extensively in the finest European theatres.

Technikote Screen Scores

Two world premieres of important 1959 "blockbuster" film releases — "Mardi Gras" and "The Buccaneer", the latter Cecil B. De Mille's last production before his untimely death—were aided by the selection of the XR-171 screen produced by the Technikote Corp. of Brooklyn, N. Y., Leonard Satz.

The XR-171, an improved version of the XR-170 (exported world-wide by Westrex) has the advantage of high brightness-gain without apparent fall-off at the sides. Complete uniformity of surface from edge to edge is made possible by a new technique of application of the pure plastic material. The screen surface is smooth, seamless and stays remarkably free of dust.

Overall Uniformity Achieved

The absence of any surface roughness in the form of embossing, whether "designed" or otherwise, has its advantages in the opinion of Satz, whose experience dates back to the first sound film. Reflectance characteristics can be maintained at an extremely high level with the all-smooth surface, and most important of all, perfect uniformity results.

Technikote also furnished XR-171 screens for the newly-refurbished Kentucky theatre, Lexington, Ky., and the Roosevelt, Miami Beach.

Conversion Notes re: C, F and K

THE term "temperature" denotes the intensity of heat which is measurable by thermometers. Liquid water, for example, has what may be called a medium temperature, while ice has a low, and steam a high, temperature.

The two most common thermometer scales, the centigrade and the Fahrenheit, were devised in the 18th century. On the centigrade, or Celsius, thermometer, the freezing point of water is set at zero degrees, and the boiling point of water at 100 degrees. The Fahrenheit scale used in England and America has smaller degree-divisions, and gives the freezing and boiling points of water 32° and 212°, respectively. Thus:

$$0^\circ \text{ C} = 32^\circ \text{ F}$$

$$100^\circ \text{ C} = 212^\circ \text{ F}$$

Scientists and engineers prefer the centigrade scale, commonly used in Europe.

Origin of Degrees K.

William Thomson Kelvin, an English scientist, devised an interesting and scientifically useful modification of the centigrade thermometer. Because the lowest temperature possible—the temperature at which all molecular agitation ceases—is 273 degrees below zero on the centigrade scale, Lord Kelvin introduced an "absolute" centigrade scale on which the coldest possible cold is specified by zero°.

To convert centigrade degrees into Kelvin (absolute) degrees, simply *add* 273 to the centigrade temperature. *Conversely*, to change from Kelvin to centigrade, *subtract* 273.

To convert centigrade degrees into Fahrenheit degrees, multiply the centigrade temperature by 9/5 and then add 32. To change from Fahrenheit to centigrade, subtract 32 from the Fahrenheit temperature and then multiply by 5/9.

As an example, to convert 122° F. to Kelvin degrees, first subtract 32 from 122. This gives 90. Then multiply the 90 by 5/9, giving 50° C. Finally, add 273 to this centigrade temperature to obtain the corresponding Kelvin temperature—namely, 323° K.

Process in Reversal

Let's reverse the process to see how Fahrenheit temperature is computed from the Kelvin. From 323° K. subtract 273. The result is 50° C. Then multiply this by 9/5 (giving 90) and add 32. The result is 122° F., right back where we started!

Care is indicated when working out temperature conversions involving below-zero temperatures. Such temperatures are written with a *minus* sign, as, for instance, –100° for 100 degrees below 0°. Negative temperatures obey the rules of *algebraic* addition and subtraction, as shown by the following interesting example.

Convert absolute zero (0° K.) to Fahrenheit degrees. First *subtract* 273 to get the centigrade equivalent. (The result of subtracting a positive quantity from zero is always a *negative* number, written with a minus (–) sign.)

$$0^\circ \text{ K} - 273 = -273^\circ \text{ C.}$$

Now, multiply –273 by 9/5, preserving the negative sign,

$$9/5 \times -273 = -2457/5 = -491.4,$$

and then *add* 32 to –491.4. (Careful here)

$$32 + -491.4 = -459.4^\circ \text{ F.}$$

Hence 0° K. equals –459.4° F. No lower temperature is possible!

Unique Kodak 3-D Projection System

A NEW three-dimensional technique for studying air turbulence has been developed by Kodak scientists. Part of studies designed to improve cameras and film for taking pictures at long range, the new 3-D technique can pinpoint moving pockets of air that deviate light rays and interfere with aerial and similar long-distance photography.

The pockets of air under study by the Kodak research team are from four inches to six feet in diameter. The air pockets have a temperature a fraction of a degree higher or lower than the surrounding air. As a result they have a refractive index different from the rest of the air. This deviates some of the light rays and causes fuzziness of the image in long-distance photographs.

Because wind causes movement of the air pockets, watching their images on a screen is like looking at a waterfall sideways. At lonely Canadice Lake, N.Y., the scientists set up two high-intensity light sources focused on a screen 1.3 miles across the north end of the lake. Each of the light sources was polarized with a filter. Behind the screen, designed for rear projection, stood an observer wearing a pair of spectacles like those once used to view 3-D movies.

1.3-Mile Look—See Into Space

A pattern of "shadows" in constant motion appeared on the screen, with each of the light sources producing a shadow of the pocket in a different place on the screen. The observer with the 3-D glasses could thus "look into" the space between the screen and the light source—getting an effect of depth—and judge the distance of each pocket from the screen.

Knowing the distance between the light sources and the distance between the shadows appearing on the screen, the scientists were able to calculate through triangulation the distance of the disturbances from the screen.

The Kodak scientists also took pictures of the screen images by holding a large piece of film directly in front of the screen, and using a shutter on one distant light source.

B&L's Big-Lens Design For Stock Exchange

Members of The New York Stock Exchange are taking a brand new look at the ticker tape these days. Recently, Bausch & Lomb Optical Co. designed and manufactured a giant projection lens which has been installed at the

Comparison between the mammoth-size B&L projection lens used at N. Y. Stock Exchange and the lens (left) used in the B&L slide projector.

Stock Exchange's Wall Street (N.Y.) headquarters. The new lens is the heart of a projection system for showing ticker tape quotations and bids on a screen.

The lens allows data on the standard ¾-inch tape to be projected 106 feet across the Exchange floor onto a large wall screen. The individual letters and figures are 2 feet high and the section of the tape is magnified to 14 feet long, making statistics easily legible from all areas in the room. Since the actual moving tape is automatically fed directly

from the ticker through the projector, the quotations move across the screen as the ticker operates.

The lens is nearly a foot in diameter, over one foot in length and weighs 65 pounds. It has a focal length of 38 inches with an F:4 speed. The lens provides a sharp image and has been especially designed to compete with the intense sunlight that usually streams through the windows high above the Exchange floor.

B&L also designed and installed special lenses for all of the projectors in the Bond area of the Exchange.

Harwald's Open House and A-V Workshop, Feb. 26-28

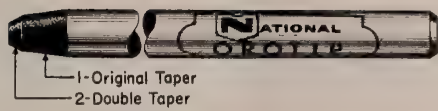
THE HARWALD CO., 1245 Chicago Ave., Evanston, Ill., will hold its annual Open House and Audio-Visual Workshop in the company's plant February 26-28. This year's session will feature speeches by authorities representing different aspects of the audio-visual field. Also, certain periods will be devoted to informal discussions and presentations of case histories and new developments. The Open House and Workshop should prove a valuable opportunity to meet and exchange ideas.

Harwald has been manufacturing A-V and professional film-handling equipment since 1946.

NCC Double-Tapered Carbon

Extensive field tests in motion picture projection rooms throughout the country during the past three years have proved the technical superiority of larger negative arc carbons with double-tapered ends. According to arc carbon engineers of National Carbon Company, the new design makes possible a much faster initial "burn-in" period and more steady arc operation.

The establishment of a stable arc at higher currents much more quickly than was previously possible with standard



National Carbon double-cored negative.

single-taper carbons has been accomplished by adding an additional taper to the already tapered end of the larger-sized negative carbons. Available in the five larger sizes of "Orotip" brand cored negative carbons—the ½-, 7/16-, ⅜-, 11/32-, and 5/16-inch diameters—the double-tapered negative carbon is priced no higher than its single-tapered predecessor and has gained industry-wide acceptance.

National Carbon Co. is currently offering, free of charge, its carbon arc bulletins, together with a handsome three-ring binder.

PROJECTION SCREENS FOR 16-MM SHOWINGS

(*Continued from page* 8)

screen sizes, may be used independently of Table III.

The plain white, or matte, screen is preferred for general school use because of its fine, smooth surface and uniform distribution of light over a wide viewing area—the average classroom, for example. Modern unperforated matte screens reflect from 85 to 90% of the light when the white surface is fresh and unsoiled. As shown in Fig. 2, different types of screen exhibit widely different brightnesses when viewed from different angles. The matte screen has the most uniform distribution characteristics, but a slight sheen increases center-line reflectivity to nearly 100%.

The angle of view should not exceed 40 degrees from the center line on each side when a matte screen is used (Fig. 3) because the foreshortening effect of perspective distorts the picture excessively at extreme viewing angles.

Highly "Directional" Screens N.S.G.

Highly "directional" screens, such as the glass-beaded and aluminum-surfaced ("silver") types, are not satisfactory for general use. Their apparent reflectivity may exceed 400% on the center line, and yet be as low as 45% at a 40-degree viewing angle. Even at a 15-degree angle, the picture brightness on a beaded screen is only

PROJECTION DISTANCE IN FEET	FOCAL LENGTH OF PROJECTOR LENS (INCHES)							
	3/4	1	1½	2	2½	3	3½	4
10	70"x52"	50"x37"	40"x30"					
15	94"x70"	72"x54"	50"x37"	40"x30"	40"x30"			
20	12'x 9'	94"x70"	70"x52"	50"x37"	40"x30"	40"x30"	40"x30"	
25	14'x11'	10'x 8'	84"x63"	60"x45"	50"x37"	40"x30"	40"x30"	40"x30"
30	16'x12'	12'x 9'	94"x70"	72"x54"	60"x45"	50"x37"	40"x30"	40"x30"
35	—	14'x11'	9'x 7'	84"x63"	70"x52"	60"x45"	50"x37"	50"x37"
40	—	16'x12'	12'x 9'	94"x70"	84"x63"	70"x52"	60"x45"	50"x37"
45	—	—	12'x 9'	9'x 7'	84"x63"	72"x54"	70"x52"	60"x45"
50	—	—	14'x11'	10'x 8'	94"x70"	84"x63"	70"x52"	60"x45"
60	—	—	16'x12'	12'x 9'	10'x 8'	94"x70"	84"x63"	72"x54"
70	—	—	—	14'x11'	12'x 9'	9'x 7'	94"x70"	84"x63"
80	—	—	—	16'x12'	14'x11'	12'x 9'	9'x 7'	94"x70"
90	—	—	—	—	14'x11'	12'x 9'	10'x 8'	9'x 7'
100	—	—	—	—	16'x12'	14'x11'	12'x 9'	10'x 8'

TABLE IV: Recommended screen sizes for 16-mm projection
(Screens slightly oversize to provide margin around projected picture)

about ¼ the center-line brightness. Beaded screens are employed primarily to give pictures larger and brighter than are possible on matte screens with low-power projectors, but they restrict the maximum viewing angle to within 15 degrees of the center line (Fig. 4).

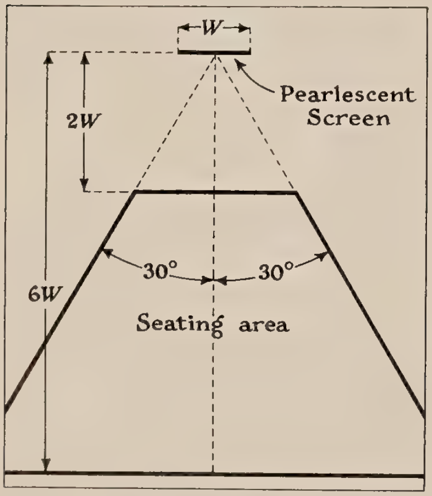


FIG. 5. The best viewing area for pearlescent screens. These screens are only mildly directional, increasing picture brightness over a moderately wide area. Pearlescent screens provide the sharp, finely delineated images characteristic of matte screens, and they are very nearly as versatile, serving all V-A needs.

Obviously, beaded screens are suited only to very narrow seating areas quite unlike those in conventional classrooms and auditoriums. Moreover, the beaded surface has a tendency to "fog" the finer pictorial detail of the projected pictures. Beaded screens have nearly the same integrated, or overall, reflectance as matte screens, but aluminum screens, another directional type, reflect only about 70% of the total light. Aside from their grainy, mottled appearance when not perfectly flat, aluminum screens also look too dim at extreme viewing angles.

Some of the advantages of the high-brightness directional screen are found in a new type of matte screen surfaced with "essence of pearl." The new pearlescent screens have a center-line reflectivity of more than 160% with a falloff to about 100% at 25 degrees, and 80% at 30 degrees.

As indicated by Fig. 5, the seating area may include viewing angles up to 30 degrees when pearlescent screens are used. The pictures will appear somewhat brighter than those on plain matte screens over a reasonably wide area, and they will be just as clear and free from grain and fog.

Oblique Projection Angles Tabu

No matter which type or size of screen is used, it should face the middle of the viewing area squarely, and the axis of the projected light-beam should intersect its center as nearly perpendicularly as possible. Oblique projection angles produce grotesquely distorted pictures, as is evidenced in theatres where excessive downward projection angles make the actors appear abnormally tall and thin.

Only with the right type of screen of the most suitable size, and properly located in relation to audience and projector, can the truly marvelous teaching power of the motion picture, the slidefilm, and the lantern slide best aid the teacher in her art of training and instructing.

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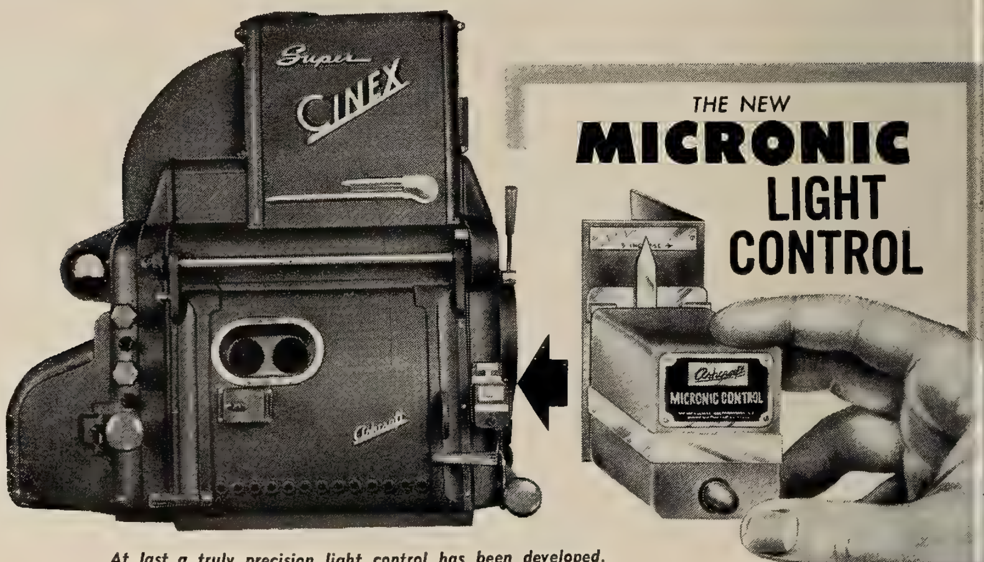

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Monthly Chat

Film Buckle Still Prime Problem

PRIME projection problem still is the out-of-focus screen image, as common in four-wall theatres as it is at drive-ins, although the latter are so desperately in need of more screen light that they risk ruining mirrors, the mechanism itself and the film print by over-amperaging the arclamp. Out-of-focus screen images are induced automatically.

Wider screens of themselves require stiff amperage levels, and the latest color films, while providing richer color rendition, have a greater degree of opacity than previous such releases.

Energy is released from a burning arc in the form of waves of different lengths and properties. A percentage of these are light waves in the region of the spectrum visible to the human eye. The remainder manifest themselves as heat without raising the level of illumination. For projection purposes, the ideal would be to eliminate all heat, since it contributes nothing to the efficiency of the system. But this is not possible, since the visible light waves themselves are also a source of heat. The only practicable solution, then, is to remove from the system those waves which do not add to illumination.

Silvered Reflector with Filter

Silvered reflectors focus the total energy released by the arc (with some slight loss) on the film gate. A heat-reflecting filter, inserted in the system between reflector and gate, prevents temperatures at the gate from becoming dangerously high. The limit of temperature control possible with this method, however, may not be adequate for the needs of the larger indoor theatres and for drive-ins.

The solution that immediately presented itself was to increase the efficiency of the heat filter. But filters have certain disadvantages: (1) their use entails a certain degree of light loss; (2) if the filter is to serve its intended purpose, all energy from the arc must pass through it. Where high amperages are used, this often results in burning out the center of the filter, particularly where the beam from the arc is focused down to less than the full diameter; (3) it is another element to be cleaned and maintained.

The answer, then, was to eliminate the filter. This has now been done in the form of the "Balcold Reflector," developed by Bausch & Lomb Optical Co., which differentiates between visible light and heat. Elliptical in shape, its second surface is coated with a combination of low- and high-index materials—visible light is reflected back to the film gate, heat passes through.

New Reflector Much More Efficient

Substantially more efficient in reducing heat than the silvered reflector-filter combination, the BALcold permits the use of higher levels of illumination with far less danger of film buckle—even of "green" film. This is especially true for high-speed and short-focus lenses with critical focusing. Also, it assures longer life for projector parts.

Whether because of ignorance of its existence or for reasons of "economy", exhibitors have purchased far too few of these reflectors. In the interest of an improved screen image no less than that he has lived with the aforementioned tribulations, the projectionist should explain the advantages of and keep urging the purchase of this BALcold reflector.

—J. J. F.

INTERNATIONAL PROJECTIONIST

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CINEMASCOPE: Keynote of Modern Projection

Some Reflections on the Past With a Look Toward the Future

By ROBERT A. MITCHELL

IN THE YEAR 1953 a new word—CinemaScope—appeared in the lexicon of motion-picture technology. Although the word was new, there was nothing *new* about the "anamorphic" process it represented, now familiar to all projectionists. As adapted by CinemaScope (hereinafter "C-Scope") the classical anamorphic process of Abbe and Rudolph (1897) and Chrétien (1929) became a beautifully simple and eminently satisfactory method for panoramic, or "wide-screen," motion-picture presentation.

Apart from the design of suitable optics, the technological success of this method rests upon the happy fact that the 35-mm film frame is sufficiently large to permit a twofold compression of the horizontal dimension without significant loss of image clarity. Only the persistent use of *curved* aluminum-coated screens by technically-ignorant theatre managements has interfered with complete public acceptance of the new medium.*

But C-Scope, like the "pseudo-panoramic" effect of cropped apertures and wide-angle lenses to impart a wide-screen effect to normal film projection, must be considered as the *result of*, rather than the *cause of*, the trend toward more realism in both the picture itself, and in the treatment accorded the dramatic elements of the photoplay (e.g., no "tight" closeups, little intercutting, and, at worst, the spasms of "method acting").

20-Year Cycles Noted

We may find it advantageous to extend our mental vision over the entire course taken by the theatrical film since its invention 70 years ago, noting with special attention those historical points where the direction of cinematic history has assumed new and radical tangents.

This intellectual task is conveniently simplified by that strange principle of historical development which seems to take the motion-picture industry by the tail *every 20 years* and fling it wriggling into unexpected avenues of evolution.

The "point of origin" is the year 1890. This was the date of Thomas Edison's Kinetograph, the first 35-mm motion-picture camera, and only four years previous to the Lumière Cinématographe, the first 35-mm apparatus used as a projector.

"Kiss-and-Caress" Era

We may aptly call the 20-year period from 1890 to 1910 the Experimental Era, for it was marked by sundry fundamental inventions and refinements in the new art of thawing the frozen immobility of the lantern-slide by photographing motion upon long strips of celluloid film. Most significant, the twitching, flickering film was first used as a story-telling medium only 13 years after its invention ("The Great Train Robbery," 1903). And toward the close of this era, the theatrical feature film was born and the "cinematograph machine" had assumed a resemblance to the modern theatre projector.

Even as early as 1910 the new "moving pictures" had enthralled the world as nothing before or since. The following 20 years (1910-1930) constitute the golden age of cinematic idealism, the Era of the Silent Film. This was the "kiss-and-caress" era characterized by the ABC's of Art, Beauty, and Charm projected in rhythms of its own creation.

Now, technology is one of the reasons why the art of the silent film, crude and archaic by today's standards of startling realism, would find no life-sustaining air in the arid expanse of the wide screen. The silent drama is too *sensitive* to be able to survive the *technical perfection* of modern cinematic techniques! This does not mean that the modern movie is "wrong;" to the contrary, it is culturally "correct" for its times.

The tone of the next 20-year period was established by a *technological revolution*, the introduction of the soundtrack. The years 1930-1950 are thus the Era of the Talking Screen. And the era opened dismally with the screen discharging hissing torrents of stilted talky-talk with no indication of the tremendous heights the movies were soon to attain on the wings of sound.

"Rama's," Scopes to the Fore

Shortly after 1950 a new cold-wave swept over the movie industry from the arctic realms of technology. It was obvious to everyone, and especially to IP

*An analysis of the optical-geometrical effects of screen curvature will be included in an article scheduled for the May 1959, issue of IP.

that a technically novel element *must* be introduced to the screen to overcome the adverse economic effects of competition from television, the "poor man's movie." Cropped apertures, Cinerama, 3-D, and C-Scope, together with a host of "rama's" and "vision's," became inevitable.

Many of the novel processes fell by the wayside, but others, l ke C-Scope, seemed to be "made to order" for the new spirit of realism which was beginning to make itself felt as early as 1950.

So here we are in 1959, practically halfway through the fourth 20-year period of motion-picture history, *viz.* the Era of the Panoramic Color Film (1950-1970). C-Scope is the "genus" of this era of dazzlingly brilliant realism, the epitome of all the technical means employed to make of the new panoramic screen a veritable theatre-stage upon which everything seen and heard is starkly real.

Resources for the Future

At this juncture we may well take stock of our resources and assets, the materiel and physical apparatus of the present-day theatrical motion picture. All of us are well aware that there is no substitute for the panoramic screen of the modern theatre. Nothing anywhere equals the vast power and scope of the modern film.

The screen's dramatists may have temporarily lost their footing before the onslaught of wide-screen technology, but there are unmistakable indications that they are regaining it now as they regained it after being temporarily engulfed by the sheer immensity of the new technology of sound recording more than 20 years ago.

We now have high-definition color films, including C-Scope, and high-fidelity soundtracks. The 35-mm C-Scope color print made from extra-high quality 35-mm negatives, or from C-Scope "55" or 70-mm Technirama negatives, now appears to be our best material for the creation of our magically realistic audio-visual "stage" having an aspect ratio greater than 2/1. (Utilization of the horizontal VistaVision negative for C-Scope prints appears increasingly desirable, according to private opinions recently expressed by progressive motion-picture technicians.) And what about our "tools" for presenting C-Scope anamorphic films?

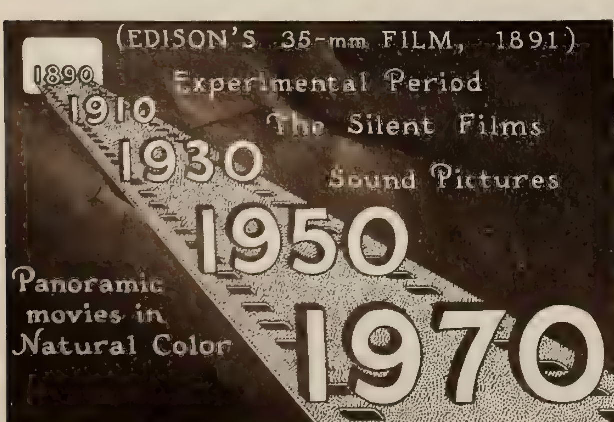
"Musts" for Projectors

Projectors for the showing of wide-screen films in general, and C-Scope in particular, must have rock-steady intermittents and efficient edge-guiding in the film gate to reduce the sideway factor which the anamorphic process doubles on the screen by doubling the horizontal dimension. Either test-target films or professional-release clips known to be sharp in focus and rock-steady in image registration should be "screened" by projectionists at frequent intervals.

One of the many excellent features of C-Scope is its remarkable toleration of film buckle. The C-Scope prime lens has a focal length considerably longer than that of the short-focus lens used for ordinary non-anamorphic, wide-screen projection. But despite the prevalence of C-Scope prints for the better and more expensive productions, standard non-anamorphic films will undoubtedly always be with us. The need for lens and aperture-plate changes will remain with us; and anent this matter we wish to offer a suggestion to projector manufacturers.

Projector Improvement Tips

Your old projectors, gentlemen, were superb in their day, and still are as examples of good craftsmanship. However, modern projection practice demands a change in the designing of mechanisms. Why, for instance, have you not produced projectors having 3-lens turret mounts for the rapid lens changes so necessary today? And we suggest not only lens turrets, but slide-up mask plates similar to the old silent-sound mask plate of the Super Simplex. Such a plate should carry three apertures: 0.825 x 0.600 inch for the conventional standard 1.375/1 aspect ratio; 0.825 x 0.446 inch for 1.85/1 non-anamorphic wide-screen projection, and 0.839 x 0.715 inch for 2.35/1 C-Scope. (The conventional aperture should still be used for non-anamorphic test projections and screen-light checks.)



An unknown law of historical development changes the character of theatre motion pictures *every 20 years!* There have thus been three well-defined periods of movie history since the invention of the art in 1890. We are now about halfway through the fourth period, the exciting era of the panoramic screen. If this era ends in 1970, what will follow?

Improved Anamorphic Lenses

The new anamorphic lens attachments are definitely superior to those made before 1955. They provide sharp, undistorted C-Scope pictures and translate to the theatre screen all the benefits of such new large-frame negatives as Technirama. The theatre owner should buy new anamorphic lenses at the very first opportunity. Procrastination can be fatal!

Regrettably, a large percentage of active theatres are still struggling to "get by" with outmoded, inadequate projection lamps. Obsolescent simplified high-intensity arclamps having non-rotating positives cannot "hold a candle" to modern high-powered lamps for flooding vast C-Scope screens with brilliant, steady, snow-white illumination.

Status of Sound Reproduction

What about sound? Except for one unfortunate factor (the use of magoptical prints with reduced-width soundtracks), the quality of film-recorded sound is at an all-time high. Much of the improvement is due to magnetic-track originals from which the optical tracks are made. The use of magnetic tracks *on release prints* is still impractical, owing to their instability under conditions of theatre usage, their high cost, and especially to the reluctance of short-sighted theatre managements to replace worn magnetic heads. Bad magnetic sound is much worse than bad optical sound.

Consider the matter of stereophonic sound, a medium which has not been nearly as effective in the theatre as its proponents had hoped. Apart from the vagaries of magnetic tracks, which shift sound direction about in an unpredictable and undesirable manner, speaker separation is not sufficiently great to give a good stereophonic effect at aspect ratios under 2/1. With a greater distance between the left and right speakers, observers seated close to the screen are annoyed by the sudden shifts of sound direction.

The best sound, strangely, is heard in theatres where the three stereophonic speaker channels are equally energized from a single optical soundtrack, a system which is free from the unnatural effects of three-track stereosound and eliminates the objectionable "point-source" characteristics of sound systems

(*Continued on page* 26)

The Carbon Arc for 16-mm Film Projection

By R. B. DULL
National Carbon Company
Division of Union Carbide Corp.

IT HAS been estimated[1] that by 1955 there were more than half a million 16-mm sound projectors in use throughout the United States by schools, churches, clubs, business organizations, and community groups. (ED.'s NOTE: The current figure approaches the 700,000 mark.) In 1957, an estimated 7000 new films were released by the *educational* film field alone[2].

At the present time the annual expenditure in the non-theatrical film field is a quarter of a billion dollars, two-thirds of which is in areas in which business and industry are making use of the motion picture[3].

The future of the 16-mm film is extremely bright as the atomic and space age gains momentum. The complexity of machines and fundamental knowledge of this era, and the ever-increasing demand for men and women to develop and operate the machines, make the use of the motion picture essential at all levels of education.

Of the 1,100,000 teachers in American schools, less than 20% are using motion picture films effectively in their classrooms[4]. This situation will eventually change, for already several states will not license a teacher who is not trained in the use of the motion picture as an educational tool.

As the non-theatrical film field expanded, it became apparent that a guide for equipment manufacturers and recommended procedures for projection of 16-mm film was needed to convert the potential usefulness of the educational film into a reality. In 1941, in response to a request from the Committee on Scientific Aids to Learning of the National Research Council, the Society of Motion Picture Engineers (now the Society of Motion Picture and Television Engineers) published its "Recommended Procedure and Equipment Specifications for Educational 16-mm Projection"[5]. Recommendations presented in the report are still being followed by equipment manufacturers.

Screen Brightness Levels

Among the recommendations made by the SMPE for the projection of 16-mm motion picture films are the following, related to screen brightness:

1. Optimum screen brightness, 10 foot-lamberts measured with shuttter running but without film.
2. Limits of screen brightness, not more than 20 foot-lamberts or less than 5 foot-lamberts.

The 16-mm film projector is portable and is used under various conditions of ambient light. The wide limits in screen brightness takes this into consideration.

The number of lumens (units of light flux) required to produce the recommended screen brightness for various sizes of matte and beaded screens are given in Table I. The values in parentheses were calculated by the author of this article.

Beaded screens are directional in character, i.e., screen brightness varies with the viewing angle. Since the brightness differences encountered over the range of viewing angles cover the recommended brightness range (5 to 20 foot-lamberts), only one set of values is given for beaded screens in Table I

Recommend 10 Foot-Lamberts

It will be noted that the recommended optimum value of screen brightness is 10 foot-lamberts. This is identical for viewing 35-mm film as specified by American Standards Association Standard PH 22.39-1953, and for 16-mm laboratory review rooms as specified by Standard PH 22.100-1955.

The most powerful incandescent lamp in general use in 16-mm film projection is the 1000-watt, 10-hour lamp, producing up to 550 lumens on the screen through an F:1.5 coated lens and shutter of 72% transmission. Table I shows that the maximum width of a matte screen this amount of light flux can illuminate to the optimum brightness is 7 feet, although a 10-foot screen can be illuminated to the minimum brightness of 5 foot-lamberts. The maximum width of a beaded screen which can be illuminated to the recommended brightness is also 10 feet.

A special 1200-watt incandescent lamp is available for 16-mm film projection, although it has not been as widely accepted as the 1000-watt lamp. This special lamp delivers approximately 600 lumens on the screen under conditions described previously herein. Six hundred lumens will provide the optimum brightness on an 8-foot matte screen, and the minimum 5 foot-lamberts on a screen slightly larger than 10 feet. A 12-foot beaded screen can be adequately illuminated by the 1200-watt lamp.

Carbon Trims Available

Screens up to 20 feet in width are common today in the projection of standard 16-mm film, and as wide as 35 feet with 16-mm CinemaScope. It is apparent that more light than can be produced by present-day incandescent lamps is required to adequately illuminate screens greater than 10-12 feet in

1. Britannica Book of the Year, 1956; Encyclopaedia Britannica, Inc.
2. Britannica Book of the Year, 1958; Encyclopaedia Britannica, Inc.
3. J. Flory and T. J. Hope, "Analysis of Growing Business Film Usage," presented at 84th Convention of the SMPTE, Detroit, Michigan; October, 1958.
4. E. C. Dent, "Films Help Break Teacher 'Bottleneck'," presented at 84th Convention of the SMPTE, Detroit, Michigan, October, 1958.
5. Report of the Committee on Non-Theatrical Equipment, Journal SMPE, 37, 22-75, 1941.

TABLE I: SCREEN LUMEN REQUIREMENTS FOR CLASSROOMS[5]

	Matte-Surface Screen		Beaded Screen
Size of Screen (feet)	Lumens for Optimum Brightness (10 foot-lamberts)	Lumens for Minimum Brightness (5 foot-lamberts)	Recommended Lumens 5-20 foot-lamberts
2-1/2 x 3-1/3	106	53	46
3 x 4	152	76	67
3-3/4 x 5	238	119	104
4-1/2 x 6	344	172	150
5-1/4 x 7	468	234	204
6 x 8	612	306	267
6-3/4 x 9	774	387	338
7-1/2 x 10	956	478	417
9 x 12	1376	688	600
10-1/2 x 14	1872	936	816
12 x 16	(2430)	(1215)	1070
13-1/2 x 18	(3076)	(1538)	(1356)
15 x 20	(3800)	(1900)	(1676)

width. This can best be achieved by use of the carbon arc.

Table II shows the carbon trims available for 16-mm film projection; light produced through a standard 0.380 inch x 0.284-inch, 16-mm film aperture with shutter running and without film and heat filter; and also the life of the carbon trim.

The carbon arc produces up to 3000 lumens of light on the screen through an F:1.5 coated projection lens and shutter of 72% transmission; whereas the most powerful incandescent lamp produces 600 lumens under the same conditions [6, 7]. It can be readily seen that the carbon arc is capable of producing *five times* as much light as the incandescent lamp, thus the screen size can be more than doubled while maintaining the recommended screen brightness of $10 \pm \frac{10}{5}$ foot-lamberts.

The film capacity of the largest standard 16-mm reel is 2000 feet. The running time of this reel, at sound speed of 24 frames per second, is 55½ minutes, thus the life of each carbon trim listed in Table II is ample.

Large Screens, Large Audiences

The SMPE Committee on Non-Theatrical Equipment has recommended the following viewing conditions[5]:

1. Distance of farthest spectator from the screen should not exceed *six times* the width of the screen.
2. The distance of nearest spectator from screen should not be less than *twice* the width of the screen for matte screens, or *two and one-half times* the width of the screen for beaded screens.
3. Viewing angle of no spectator should be greater than 30 degrees with a matte screen, or 20 degrees with a beaded screen.

The aforementioned recommendations and seating capacities—based upon the use of 20-inch seats, 32 inches back-to-back, with a limit of 14 seats between aisles as prescribed by the laws of some states—show that presentation of 16-mm film with the carbon arc can be made before a maximum audience of 1000 persons at the *optimum* screen brightness of 10 foot-lamberts, or 1200 persons with a 20-foot screen at a brightness of 8 foot-lamberts. Larger audiences can be accommodated at the *minimum* screen brightness of 5 foot-lamberts.

How far the screen brightness can or should deviate from the optimum 10 foot-lamberts depends upon the *amount of stray light* falling upon the screen. Picture quality is dependent upon the ratio of limits established between the screen brightness and the stray-light brightness on the screen. The stray-light ratio in theatres should not be greater than 0.3% of the screen brightness[8]

The aforementioned maximum audiences are based upon the assumption that stray light is no greater than normally encountered in a theatre, a condition not always realized in rooms not designed for the exhibition of motion pictures.

Economy and Ease of Operation

Another advantage offered by the carbon arc is the decided economy of operation. At present-day carbon and power prices, the operating cost for "Pearlex" carbons is approximately 30 cents per hour, and 13 cents per hour for the "National" projector carbon. The 10 hour, 1000-watt incandescent lamp has an operating cost of approximately 60 cents per hour. Thus, the "Pearlex" carbons can be operated at about one-half the cost of the incandescent lamp while delivering 3 to 5 times as much light. Likewise, the "National" projector carbons can be operated at 1/4th to 1/5th the cost of the incandescent lamp and deliver 35% more light.*

To an inexperienced observer, the carbon arc may appear greatly more complicated to operate than an incandescent lamp. Actually, it is no more difficult than threading film through the projector.

Color Quality of Light

The operating characteristics of the "Pearlex" carbon arc trims are similar in many respects to those of the "Suprex" carbon widely used for 35-mm film projection, but with certain modifications of color quality[9]. In the snow-white color of light typical of the high-intensity arc, the spectral energy distribution is characterized by an essentially even balance of energy throughout the different colors of the spectrum, which is particularly desirable for the projection of 35-mm color film.

The 16-mm color film has been color-balanced for projection with incandescent lamps, however, and these lamps differ from the high-intensity arcs in that their light is relatively very low in energy in the blue and very high in energy in the red portions of the spectrum. As a result, when 16-mm color film is projected by the snow-white light of the high-intensity arc, the blues are over-emphasized and the reds are subdued.

The light of the "Pearlex" carbons has been adjusted to meet the requirements of the 16-mm color film by subduing the blue light and intensifying the red. This has resulted in a color of light which is satisfactory for both 16-mm black-and-white and color film projection. Color temperature of the screen light produced by "Pearlex" carbons is approximately 4450 degrees Kelvin. The SMPE Committee on Non-Theatrical Equipment has recommended that color temperature of light delivered to the screen be in the range from 3000 to 4700 degrees Kelvin[5].

If, as is often said, one picture is worth 10,000 words, then the motion picture must be worth many times 10,000. Expansion of the use of 16-mm film for training and educational purposes is inevitable. The carbon arc is well suited for the projection of 16-mm film because it produces more light than any other available light source and at a lower operating cost.

The increased screen size that can be adequately illuminated by carbons designed for 16-mm film projection makes practicable showings before a comfortably-seated audience of 1000 or more under conditions conforming to the best standards of projection practice.

6. Eastman Kodak Instruction Bulletin 8-58-GLP-A, Eastman Kodak Co.
7. Audio-Visual Equipment Directory, Fourth Edition, 1958. National Audio-Visual Association, Inc.
8. Estes, R. L., "Effects of Stray Light on the Quality of Projected Pictures at Various Levels of Screen Brightness", Journal SMPTE, 61, 257-272 (1953).
9. Lozier, W. W. and Joy, D. B., "A Carbon Arc for the Projection of 16-mm Films", Journal SMPE, 34, 575-579, 1940.

TABLE II: ARC CARBONS FOR 16-MM FILM PROJECTION

Carbon Trim*	Amps.	Volts	Screen Lumens	Life
"National" Projector				
6.4-mm x 8-½" Positive	10	50	750	135 min.
5-mm x 7-½" Negative				
"Pearlex" H. I. Projector				
6-mm x 8½" Positive	30	28	1600	58 min.
5.5-mm x 6" Negative				
7-mm x 12" Positive	46	35	3000	80 min.
6-mm x 9" Negative				

* All carbons are copper-coated

*NOTE: The terms "National," "Pearlex" and "Suprex" are Trade Marks of Union Carbide Corporation.

One of Britain's ablest technicians evaluates overall technological processes within the motion picture industry. The author has long been regarded as an outstanding practitioner of the cinematic art, and his views should command the attention of those who are interested in A-V presentations.

Projection Pot Pourri:

Light Source, Image Ratios, Film Sizes, Screens

By J. L. STABLEFORD

THE new Philips projector and light source are a milestone in motion picture development. Howard Cricks has already written about them at length and with enthusiasm, so I need not recap what has been covered (IP for November, 1958, p. 8). Reliable information as to cost prices of projector and lamp bulbs is not available, and one cannot essay an opinion upon economics *viz-a-viz* carbon arclamp projection or the Xenon lamp.

Outstanding features are the 72-per-second light pulsation and the horizontal nature of the light source. I felt that the large CinemaScope picture shown at Photokina (Cologne, Germany, exhibition) was overstretched beyond the capacity of the lamp. Immediately, one must admit it would be very hard to go back to 48 cycles per second after enjoying any extended run at 72.

Screen Light Distribution

The evenness of the illumination across the screen showed that the horizontal or cylindrical properties of the light source suit very well the elongated picture format such as CinemaScope. I am not convinced that 95% center-to-side distribution makes for the most pleasing or sparkling picture, It would be interesting to know what the North and South distribution is.

With the 3 light pulses per frame, by inference the projector has a 60° pull-down (although I have neither read nor heard any comment to this effect), otherwise the respective light and dark periods would be asymmetrical. If this be so, I presume that the shifting movement will have reasonable wear characteristics and not affect print life through increased acceleration and deceleration stresses.

If the new Philips lamp is to be adapted to *existing* projectors, it will suffer a 33 1/3% drop in light output, because the light flashes will have to be reduced from 3 to 2 per frame. The flash duration could not be extended without a severe drop in color value, thus it is most unlikely that adoption of the lamp, without its new projector, presently could be considered.

This new light source and, to a lesser extent, the projector, further clears the way already opened up by the Xenon lamp for the film industry to take another look at the vexing and hesitant subjects of rationalization and standardization.

Favors Mainly 35-mm Film

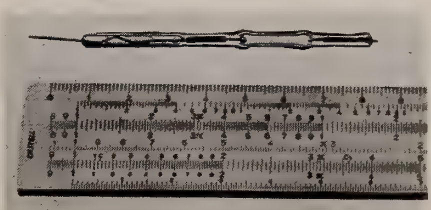
For economic reasons, it is my view that film projection equipment throughout the world must, in the main, remain with 35-mm filmstock. Pressures against it come from two directions: one for higher quality, hence wider films such as 70-mm; the other, a means for reducing costs, so that a stand may be made against the heavily favored position of TV.

Moreover, does anybody believe that the industry can cope indefinitely with three different picture shapes? It is being tolerated, but it is about as efficient as a man wearing three hats at the same time.

Suggests 5-Tooth Pull-Down

I have written on methods of producing high quality screen images employing existing projectors and standard 35-mm filmstock, mainly by adaptation to 5-tooth pull-down—with a negligible capital outlay. At Photokina I talked with a leading lens designer, experienced with anamorphics. His snap opinion was that my 5-tooth, no-reduction, 2:1 squeeze print from a Todd-AO or similar 70-mm negative would suffer but very little from quality drop, provided printing was done directly from the 70-mm negative.

The new Philips SPP discharge lamp, shown with holder, is only 3¼ inches long.



Should it be done as a contact print, taken off an already squeezed dupe negative, then there would be some reduction in quality, although the result would still be well above average. Following a practical approach, if the print were taken off a full 70-mm width dupe negative, then the drop in quality would be small and consistent with that extra step.

If prints with 5-tooth pulldown, good enough for luxury projection, became established, they would represent a 25% increase in print cost, reel sizes and so on—minute compared with the cost of full 70-mm prints, not to mention the capital expenditure necessary to employ the big prints.

One thing which has been crystallizing in my mind of late is the seeming determination of some in the industry, and a die-hard section in particular, to go to the other extreme in holding to standard wide screen, with no anamorphics and no big prints.

Unfavorable Wide-Screen Factors

Now, wide screen of 1.75- and 1.85:1 aspect ratio causes significant losses of picture frame area, light, quality and a host of disagreeable factors. It produces these losses almost entirely through cropping down from the full frame height pitch of 0.748 inch. One might equally well term it *via* a gargantuan black framing bar, interposed between each frame, representing up to 0.302 inch, or 40.3% of the running footage.

A 2:1 aspect ratio represents the *useful* employment of 55% and *absolute wastage* of 45% of the total film footage —almost criminal. Furthermore, this latter quantity of light from the lamphouse is totally wasted and heats up the gate. If these diehards mean to stay with their wide screen, no-anamorphic approach, I suggest that they cut out all losses and disabilities in one fell swoop.

Can we pretend any longer that exist-

(*Continued on page* 25)

The Geneva Intermittent Movement: Its Construction and Action

The fourth in a series of articles which detail the what, the why and the how of the "heart" of the motion picture projector.

By A. C. SCHROEDER
Member, IA Local 150

ELLIPTICAL gears are costly and difficult to cut without special equipment. Thomas A. Edison, on his last machine, used a system of levers to obtain similar results. Fig. 11 shows a layout which produces a varying angular velocity of the driven shaft. *E* is the flywheel, fastened to shaft *F*, on the other end of which is the lever *G*. In the upper end of *G* is the pin *H*, the dotted lines being a continuation of the pin, which portion is hidden by *I*, a forked member fastened to the camshaft and shown better in the end view in Fig. 12, the flywheel and the cam *J* not being shown here.

The dotted lines show portions of lever *G* which are hidden by the forked member *I*. Pin *H* is the only means of transmitting motion from *G* to *I*. *H* is continually sliding in the slot in *I*. When both levers are vertical (the position they are approaching in Fig. 12) *H* is very close to the camshaft *K*, and the speed of *K* will be much greater than that of the flywheel shaft *F*. After leaving the vertical position, the lever *I* decelerates, because the pin slides farther away from *K* as the motion progresses.

In Fig. 13 the levers have almost reached the vertical position again, but in the downward direction. The pin is nearly at the end of the slot, and *K* is turning relatively slowly. When the levers point straight down, *K* is moving at the slowest speed; from here on it again accelerates.

Star Slot Engagement

I, in Fig. 12, is 45 degrees from the vertical, and the cam pin is just entering the star. The star movement is completed when *I* is 45 degrees past the vertical, a total of 90 degrees. Lever *G* is 16 degrees from the vertical position, and when the star movement is completed it will be the same distance past the vertical, a total displacement of 32

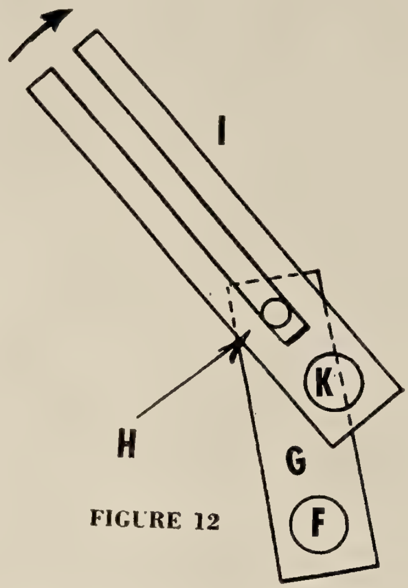


FIGURE 12

degrees. Here the 9 degrees of cam rotation is obtained by only 32 degrees of *flywheel travel*. Thus, we have 328 degrees of flywheel travel in which the film remains stationary, allowing more time for projection to the screen, deducting that lost due to the flicker blade on the shutter, of course, as we also do in conventional projectors.

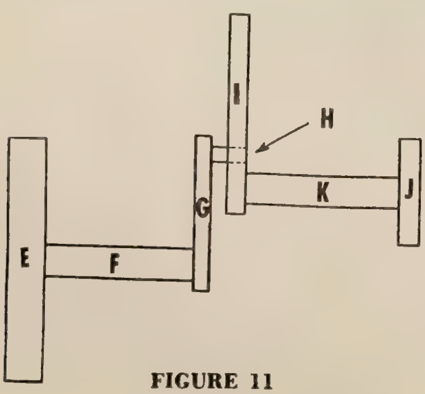


FIGURE 11

If we place the shafts *F* and *K* in line with each other, we find that the pin does not slide in the forked member *I*, but remains fixed in one position, relative to *I*, although both levers are revolving. The angular velocity of *I*, then, is constant and equal to the driving member *G*. No advantage is obtained from the levers, and the movement has a three-to-one ratio, requiring 90 degrees of flywheel travel to effect the film transfer.

If camshaft *K* is displaced only slightly from the in-line position, the pin moves slightly within the forked member and the speed of *I* begins to vary, increasing as the levers move in an upward direction, decreasing as they move in the downward direction.

The amount of speed variation depends on how far the shafts are out of line, and if *I*, *J*, and *K* are arranged so that they can be moved relative to shaft *F*, then

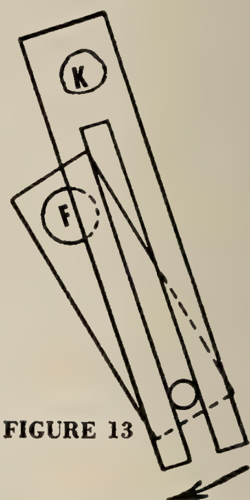


FIGURE 13

the *variation* of camshaft speed can be changed at will.

The Old Edison Method

This is what Edison did. Obviously, the cam and camshaft cannot be moved very easily. (These parts actually move in all our machines, but this is done for framing.) Edison used two more levers, as in Fig. 14. Both driving levers are marked *G*, both pins are indicated by *H*,

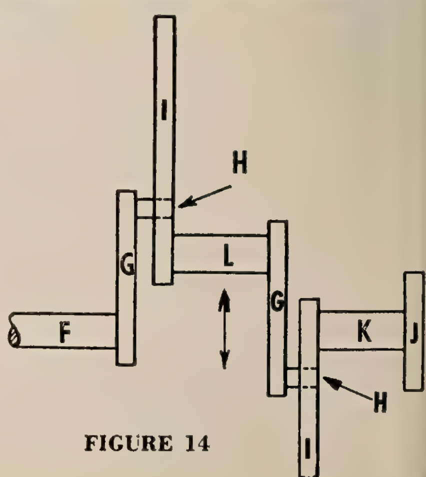


FIGURE 14

and the forked levers are I. Notice the third shaft L, which is moveable in an up-and-down direction, indicated by the double-pointed arrow.

When L, together with the two levers fastened to it, I and G, is moved downward so that it is in line with F and K, the drive is straight through, just as though F and K were connected by a shaft, and no variation in the angular velocity of K results.

As shown in Fig. 14, pin H in the first lever is very close to shaft L, causing a large variation in the speed of L, the latter being shown at the position where its speed is greatest. At the opposite end of L the lever G points straight down, and *its* pin is close to shaft K, and K turns at its greatest speed. The condition is such that the speed variation is multiplied: not only has the speed of L been greatly increased, but at the same time L, through means of *its* lever G increases the speed of K, and consequently the speed of cam J.

The Decelerating Action

In Fig. 15 the parts have turned one-half revolution from the position in Fig. 14. The first two levers have greatly slowed down shaft L, which in turn has slowed down the camshaft by means of the second pair of levers. By the use of this double system of levers, the effective speed of the movement can be changed without moving the camshaft; only the shaft L and its connected levers are moved up or down. This causes no complications, because the only connection to L is through the two pins H, which are free to move in their respective slots.

The actual displacement of L from the in-line position was only a small amount. A larger displacement causes so great an increase in the speed of the movement that the film simply cannot stand the terrific strain. This strain is not due to the conditions set forth in our basic introductory figures, because our present cam and star is actually a 3-to-1 movement and operates as shown previously.

Slight Speed Increase Possible

But even such a movement will, if the projector speed be increased enough, strain and eventually tear the sprocket holes. This is what happens when the movement is accelerated by a system of levers or through the use of elliptical gearing. Only a slight increase in speed is therefore permissible, and each increase calls for greater film tension to assure the film stopping in the proper position. Of course, the increased tension produces more strain on the film during the period in which it is started and accelerated.

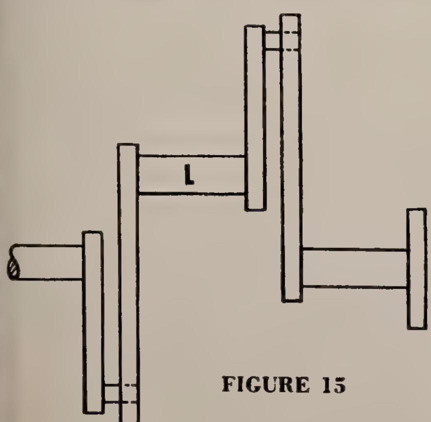


FIGURE 15

[TO BE CONTINUED]

Viewing the Projector as an Integral Optical-Mechanical System

By HAROLD E. ROSENBERGER

Bausch & Lomb Optical Company, Rochester, N. Y.

Components are all right in and by themselves, says Mr. Rosenberger, but when they are *assembled* into one unit to provide optimum results they often fail to deliver wholly satisfactory results. This article, excerpted from a paper originally presented before the Society of Motion Picture and Television Engineers suggests how best this integration might be achieved.

With the motion-picture projector as the one notable exception, optical instruments are conceived, designed and manufactured as integral optical-mechanical systems under the control and supervision of one prime manufacturer. Under this system, the manufacturer has complete control over his product and is in a position to establish the compromises among the *individual* components which will result in the best *overall* performance of his instrument.

Even though many of the components might be purchases from other suppliers, the prime manufacturer controls their design through his specifications and assumes the responsibility for their performance in his finished product.

From the point of view of the customer, the advantages of this method of manufacturing are self-evident. The potential purchaser of a telescope, for example, does not have to inquire about the speeds, or focal lengths, or field coverages of its many optical components. Since he is concerned only with the performance specifications of the complete assembly, he can fairly painlessly make his choice among the products of the various manufacturers.

Projector Not Integrated

The task confronting the potential purchaser of motion-picture projection equipment is not so simple, for he is a victim of the exception to the rule we referred to in the beginning.

From the point of view of realizing the best in overall performance, the motion-picture projector most certainly should be considered as an integral optical and mechanical system. In practice it more aptly fits the description of being a *collection* of optical and mechanical parts. The problem of selecting and assembling the components (designing the projection system is probably more fitting) with the aim of securing the best overall performance is a burden which falls on the projection people.

To the parts manufacturer, this practice is both an advantage and a disadvantage. It is an advantage because to a large extent it relieves him of responsibility for the performance of his product. It also provides him an easy opportunity to exploit as a sales gimmick some feature of his product which, though desirable, cannot be utilized because of limitations imposed by other components of the system.

The conscientious manufacturer, on the other hand, finds himself at a disadvantage, since his refusal to join the "battle of numbers" costs him sales.

We suggest that the projectionist take

(Continued on page 23)

"I suggest that you keep the tube and change the equipment."

By Ed McCormack, L. U. 582, Brantford, Canada.

A-V Education: A New Era Dawns

The second and concluding installment of excerpts from the address by Maurice B. Mitchell to the Society of Motion Picture and Television Engineers on the occasion of their Fall (1958) Convention at Detroit. Informative and provocative, this exposition provides much mental food to the, at present, sadly undernourished workers in the A-V area.

Mr. Mitchell is president of Encyclopedia Brittanica Films, Inc., and has actively strong ties with Massachusetts Institute of Technology.

LET us describe the classroom of tomorrow as it will be equipped for audio-visual education. It will be set up so the room can be effectively darkened. It will have no projector; it will use no film. There will be a sheet of glass in the front of the room, a part of the blackboard, on which the instructor can write in chalk. Next to it will be the telephone dial, and from the dial will hang a telephone book, and in that book a catalog of every audio-visual device, film and film strip that has been made.

The instructor will look up the number of the film he wants, and dial it. The picture will appear instantly on the screen, flown through space by micro-wave relay to the saucer on the roof, and a stream of electrons will paint it on the screen.

The things I am describing are in the present state of the art. No inventions, no breakthroughs are required. We could do it now. All we need is the profound conviction that it is this kind of teaching tool we want the nation's classrooms to have.

Correlated Programs

The right film, the right place, the right time. . . ! Institutions where effective and advanced use of films is now made include the huge library in Georgia which has the largest single collection of educational motion pictures in the United States. It sends out 200,000 classroom films a year to Georgia schools, postage paid both ways.

A library in the Province of Ontario had classroom audiences running to 10,300,000 students last year. The Morton Township High School in Cicero, Ill., uses 60 sound motion pictures a day.

The Soviet Accomplishment

I have sketched some implications in the communications revolution for education. We are only on the starting line. Many things we have come to accept as routine will change radically.

Douglas Johnston of the London County Council, which runs the schools in the capital city of Great Britain, took a team of British teachers for a hard look at the schools behind the Iron Curtain. He described the average Russian classroom in a school of 562 students.

The teacher stands at the front of the room. In front of him is a control panel of switches. He darkens the room by remote control. He activates a projector threaded with films from his own private film library assigned to his subject area and kept in his school building.

Wide Procedural Choice

He can start and stop the projector. He can run it back and start over. He can knock out the soundtrack and let a student narrate the film to demonstrate his understanding of the concepts. If he wishes, he can project, simultaneously on the same screen, film strips from a separate film-strip projector. He also has an overhead projector. What was found in the science classrooms was also found in the geography and history classrooms.

There is tremendous use made of the tape recorder in the Soviet Union for the study of languages. I am told there are 43,000 teachers of English in the Soviet Union. I am further told that not a single institution of higher learning in Ohio teaches Russian. And I am told at M.I.T. that 10 years from today a student in the sciences who has Russian and English at his command will hold the key to 80% of the scientific literature of his time.

Have We Any Option?

Technological and communications revolutions have a way of destroying the options of those who live through them. The businessman in the buggy-whip business had no option. He adapted to the technology of his times, or he was dead. Perhaps in education the same holds true.

What option do we have to ignore the products of our communications revolution? If we do, what price will we pay? What will be the outcome of the desperate struggle for men's minds? Is all this just news of damnation—or can it be, if we will make it so, *the good news of damnation?* This is the challenge.

It comes at a difficult time. We haven't the money to build the buildings, to train and pay the new teachers we need to absorb the flood of population pouring into our schools. How we solve these problems may determine how we live a generation or two from now.

[ED.'S NOTE: The above is a severe abridgement of Mr. Mitchell's substantial address. Full details and supporting argument have been published by Fenn College.]

In Memoriam

HARRY SHERMAN

MARCH 3, 1952

BOOK REVIEW

LIGHT, by Alexander Efron, E. E., Ph. D. Published by John Rider, Inc., 116 West 14th St., New York City 11. One of the Basic Science Series. 128 pages, profusely illustrated. Price: $2.25.

As is typical of the series, this book gives an excellent account of the subject in a mature, well thought-out presentation. The text will prove invaluable to anyone who owns a camera, uses a magnifier or microscope, or who is concerned with home or office lighting. Students of physics will find the discussion is much broader and more thorough than usually found in an intermediate-level text.

After a discussion of various beliefs about light and descriptions of methods used to determine the velocity of light, the book considers behavior from the viewpoint of light rays. Later, the wave-theory of light behavior is covered, and reflection and refraction are re-examined from this outlook. The use of full-color illustrations at the appropriate place in the analysis of the spectrum is of great help in understanding the topic.

The section on optical instruments, including the eye itself, and how these instruments function is fascinating. The final chapter deals with sources of light, the energy of light and recent developments in the field of illumination.—J.J.F.

Chicago L. 110 Election

A special election of officers for IA Local 110, Chicago Moving Picture Operators Union, had the following results: president, Howard Blackwood; secretary-treasurer, Ralph Mooney; business manager, Clarence Jalas, and trustee, Arnold Swanson.

These officials, excepting Jalas, were elected for unexpired terms ending in 1960; the term of Jalas, former secretary-treasurer for many years, runs until 1963.

AUDIO-VISUAL
EDUCATIONAL • INDUSTRIAL • COMMERCIAL

Student-Prepared "Opaques" a Great Aid

AMONG the almost endless classroom uses of the opaque projector, the exhibition of "home-made" materials is extremely effective from the instructional point of view. Such materials may include written work (assignment papers in mathematics and science, word lists and other language exercises, social-science tests, field-trip reports, etc.) and drawings prepared expressly for projection purposes. Vivid dramatization of study projects by means of pictures drawn *by the students, themselves*, provides an unfailing guarantee of attention and interest.

According to a survey conducted by IP, many pupils who have previously appeared somewhat reluctant to express themselves suddenly evidence a gratifying expansion of personality when given the opportunity to comment upon their projected material. The opaque projector thus possesses remarkable efficacy as an instrument of psychological therapy. It would seem that few students, on up to and through the high school terms, offer much mental resistance to this type of approach.

High Contrast Requisite

Now, diagrams and other art work intended for the opaque projector should be as *contrasty* as possible. Because opaques are projected by diffused *reflected* light, they often lack the "snap" and brilliance of lantern slides, motion-picture films, and other transparencies projected by *transmitted* light. To obtain maximum contrast, even written work should be prepared in black India ink on white bond paper.

Simple line diagrams likewise show up best when done in black ink on snow-white paper. Pencil drawings usually give disappointingly faint images on the screen. When pencils *must* be used, the softest leads give the best results. Wax crayons are unsuitable because of their tendency to melt under the heat of the lamps.

Colored art work for satisfactory opaque projection calls for the use of colored inks, water-color paints, or "show-card" tempera colors. Pastel crayons may also be used; and black-and-white diagrams may be colored with colored pencils (e.g., maps, graphs, and scientific diagrams).

Some Excellent Colors

Regular artist's water colors are excellent. The "saturation," or brilliance, of the colors should be exaggerated somewhat to compensate for the dulling effect of projection, hence the desirability of having at least a few tubes of the extra-brilliant water colors used by commercial artists.

The handiest colors are intense red, vivid green, deep blue, magenta (brilliant rose), lemon yellow, and cyan (turquoise). The latter three are the painter's "primaries," and may be mixed to produce new colors. Striking color effects may be obtained with fluorescent show-card water paints, such as "Da-Glo."

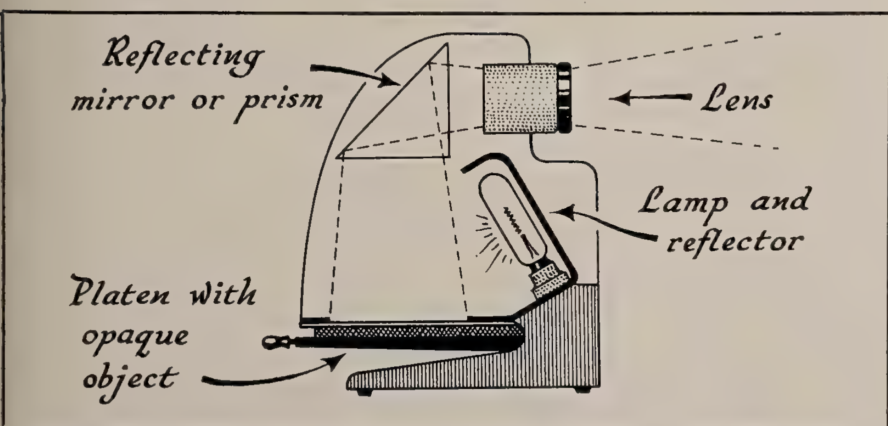
To increase the apparent brilliance of the darker hues (blue, violet, purple, and amaranth), advise the students to thin such colors with water to the point where they *just begin* to assume the light character of tints. Certain deep greens may also be brightened by thinning the paint with water.

The color should be applied to the whitest bond paper or light cardboard available. A heavy weight of paper works best, inasmuch as water paints tend to wrinkle thin paper. The desirability of a smooth working surface rules out rough water-color paper for most work.

Large Free-Hand Lettering

Students should be encouraged to do all lettering in a large "free-hand" style to promote legibility and to avoid a "cramped" appearance. Their innate artistic abilities are developed most rapidly by speed of working, rather than by a painstaking re-working of tiny details. Errors of execution should be tolerated. The use of white and colored tempera paints on black and colored papers offers a fruitful field for interesting experimentation.

The brightest, most distinct opaque projection is obtained upon glass-beaded screens in effectively darkened rooms.



The opaque projector forms an image by light rays *reflected diffusely* from an object placed upon its platen. This type of projector is accordingly less efficient optically than a transparency projector, which forms an image by *transmitted* light. A beaded screen and a well-darkened room are thus necessary for satisfactory opaque projection.

The large prism behind the objective lens functions as a mirror to preserve the orientation of the image. Without such a reflecting component, the left- and right-hand sides of the image would be reversed, as in a mirror, and printing would read backwards!

Teachers are invited to submit problems connected with the preparation of student art work for analysis and reply in this section by the staff artists of IP.

Observe Your Projector Oiling Instructions!

THE LUBRICATION of a 16-mm motion-picture projector is a matter of the greatest importance to the length of its life and the quality of the service it provides. Many of the older machines require rather frequent oiling of all bear-

ings and gears. Some of the newest projectors need no lubrication at all!

A complete "oil check" after every 100 hours of operation (once a month, on the average) is a safe rule for an old projector. The required tools are a small, long-nosed oilcan and a package of toothpicks. Use a light machine oil if the lubricant sold by the manufacturer of the projector is not available.

The oilcan should be used for applying oil to the oil-tubes and large bearings; a toothpick for applying single small drops of oil to the smaller bearings. Oil all of the bearings, including the sprocket and idler-roller shafts, reel-arm pulleys, etc. Apply oil to gear teeth with the finger.

Some Oiling "Don'ts"

Do not use light oil in grease cups. Do not overoil or spill oil into the film gate, on the lenses, or on the sound drum or sound lenses. Carefully wipe off all excess oil.

While overoiling increases the accumulation of grime and impairs the performance of a projector in many ways, insufficient lubrication accelerates the wear of mechanical parts and makes the machine noisy in operation.

RCA and Kodascope

Indiscriminate lubrication of the newer projectors should be scrupulously avoided. Such 16-mm machines as the RCA "400" and the Kodascope Pageant projectors have self-lubricated bearings and normally *never need additional lubrication.* (When operated continuously, as in preview rooms and TV studios, the RCA "400" requires 2 or 3 drops of oil after each day of use in each of the two oil holes on the top of the projector above the upper sprocket.)

Certain other new projectors require occasional limited lubrication. This should be applied *strictly* according to the manufacturers' instructions. The following résumé has been compiled from the official recommendations.

DeVry "5" and "15" Units

The DeVry "5" and "15" projectors, such as the Model 14000-CC, are completely equipped with "oil-cushioned" bearings which insure long life to the moving parts without the need of additional lubrication. The drive motor is likewise lubricated for life.

The shuttle-and-cam intermittent mechanism of the DeVry "5" and "15" is supplied with oil by an oil reservoir which unscrews for refilling. Check the oil level in the reservoir periodically and refill as required with DeVry Oil no. 13111-DA only. A completely filled reservoir may be expected to provide adequate lubrication to the intermittent mechanism for 500 hours—from 6 months to a year under average school use.

A drop of light machine oil should be applied occasionally to each of the external idler-roller shafts of the DeVry with a toothpick. Guard against soiling the sound drum or the sound lenses. Place a few drops of light oil in the oil hole of the takeup drive pulley (top of mechanism case).

Victor Animatograph

The Victor Animatograph projector, known variously as the "Classmate," the "Assembly," and the "Sovereign," needs only to have its "one-shot" oil tube filled with light machine oil after every 100 hours of operation (1 to 2 months under average school-use conditions), and its reel-arm bearings greased (not oiled!) once a year.

Ampro "Premier 40"

The Ampro "Premier 40" should be lubricated whenever it has been stored unused for more than 30 days. In normal use, apply 3 drops of Amproil to the central oilwell and to the oilwick in the vertical camshaft bearing after *each 15 hours of operation.* Apply 3 drops of Amproil to the oil hole at the end of each reel arm, and 1 drop to each of the film guide-roller studs, after *each 75 hours of operation.* Rotate the rollers in order to distribute the oil, then wipe off any oil which may have fallen upon the faces of the rollers.

Bell & Howell Filmosound

The Bell & Howell "Filmosound 285" projector has three capped oil tubes on the top of the case. One drop of B & H Projector Oil should be introduced into each of these after every 10 hours of operation.

The three sprocket-shaft bearings have felt reservoirs which should be saturated with B & H Projector Oil every 6 months. To do this, lay the projector on its side. Insert the tip of the B & H oil-can in the holes (at the ends of the sprocket shafts) and squeeze the sides of the oil-can 3 times. Place 1 drop of oil on the shafts of the snubber and guide rollers after each 100 hours of operation.

Do not lubricate the feed-arm spindle or pulley of the Filmosound at any time, but after every 100 hours of use add B & H Reel-Arm Grease to the grease cup on the end of the takeup arm.

Using Closed-Circuit TV in Education

By FRANCIS E. ALMSTEAD

Special Consultant on Educational Television

New York State Education Department

Full utilization of the tremendous potential of the electronic arts will occasion a revolutionary change in teaching methods. This is the opinion of educators who are already using these media of communication, notably the group in New York State whose activities in this field are detailed in the appended first of a series of articles.

TODAY the New York State Education Department is conducting a very extensive investigation of all phases of the television medium. Its four experiments in broadcast and closed-circuit TV embrace many techniques and technical arrangements. One of these, a broadcast project, began on September 22nd last over Channel 11 in New York City.

These broadcasts may be viewed in four states, eight hours a day Monday through Friday. The viewing area in New York State has a million and a half public school children. In the Regents' broadcasting schedule there are six elementary grade subjects and six secondary school courses. Each of these follows a regular approved State syllabus.

Two other experiments are located in State University Teachers Colleges in Brockport and Albany, where closed-circuit facilities are used from grade three through college. These systems use video distribution and a separate two-way audio circuit. The facilities are within a single building at each college.

In Cortland County the Department is experimenting with closed-circuit facilities involving three school districts. Schools are connected by coaxial cable and use an independent pupil talkback system. These facilities in four locations are financed by State appropriations and give the Department the greatest undertaking ever attempted in educational communications by one institution.

The Educational Objective

In Cortland County, New York, educational TV connects three school systems, one in a city and the other two in villages (see illustration). These are directed by two superintendents and three Boards of Education.

The superintendents, working in close cooperation with faculty mem-

bers, proposed a plan whereby the three school systems could exchange benefits with each other through closed-circuit TV. This plan incorporated four basic questions, the first phrase of each being "by using TV facilities":

Prime Questions Posed

1. Can pupils in small schools have the advantages of services usually found only in large schools?
2. Can teaching talent be extended successfully into more than one classroom at a time?
3. Can the level of learning be raised?
4. Can schools provide courses which are now prohibited by excessive cost?

In the city of Cortland, there are about 4500 pupils housed in five elementary schools and one junior-senior high school. In Truxton Central School there are 600 pupils in grades K through 12. In Virgil Central School there are 400 pupils in grades K through 12.

By committee action it was decided to equip all second and fifth grade rooms in the elementary schools and a number of high school rooms in the three systems with TV receivers. It was further decided to teach science to the elementary school grades, and basic art, English, health, and mathematics to high school pupils. Teaching schedules began on September 29, 1958.

System Design Requirements

This system, because of its uniqueness, offers great promise and already has aroused much interest. To serve as headquarters for the project and to house the studios, the city of Cortland Board of Education released a two-room elementary school building no longer in use. The Board has refurbished the building.

While origination may take place at any of the six Cortland schools, teaching is done in the modern studios at the once "little red school house."

Studios, control rooms, and classrooms have been equipped with electronic and TV items by the State Education Department. Radio-frequency distribution and independent talkback systems have been installed by the New York Telephone Co., and are being rented by the Department. The total system was planned with specific operating conditions in mind, some of which are:

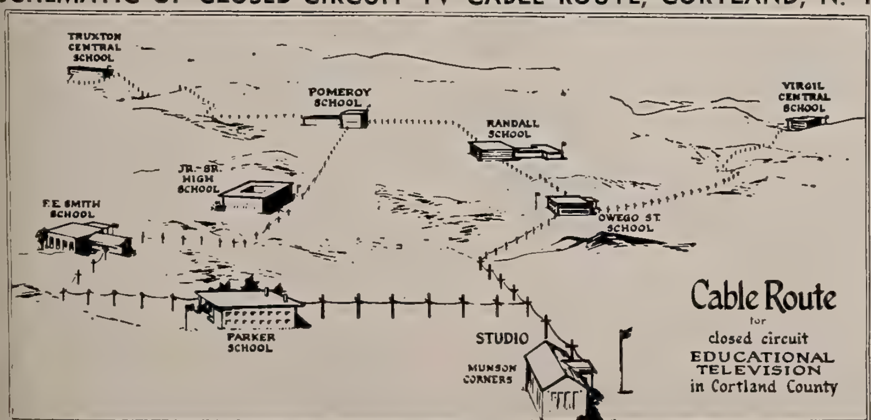
Specific Operating Conditions

1. Pupils should be able to see in full detail all of the intelligence transmitted by the TV cameras without distraction or distortion.
2. Camera chains should be capable of faithfully reproducing the full intelligence in a picture, microscopic slide, printed matter, movie or transparency.
3. Natural atmosphere of a classroom should be retained in the viewing room.
4. Pupils should be able to hear all sounds without distortion, distraction, discomfort, or undue effort.
5. Pupils should be able to ask questions and receive immediate answers from the studio teacher.
6. System should be designed as an educational communications center capable of serving the entire school community with live lessons, motion pictures, slides, special programs and demonstrations, stereophonic recordings, and two-way audio programs.
7. System should permit separate transmissions to elementary and secondary schools simultaneously.

To meet these objectives two fully equipped studios and two radio-frequency channels have been provided. In addition, adequate distribution systems within each school, including high quality receivers, have been installed.

[ED.'s NOTE: Data relative to studio design and equipment and the classroom equipment and its utilization will be presented in subsequent issues, beginning with the next.]

SCHEMATIC OF CLOSED-CIRCUIT TV CABLE ROUTE, CORTLAND, N. Y.



Sound *versus* Noise

PEOPLE WHO live next to the railroad tracks find—after a few sleepless nights—that human beings have a remarkable capacity to adjust to irritating sounds. Psychologists have learned, however, that while the conscious mind may shut out bothersome noise, the "inner man" continues to be irritated.

Watch a man listening to a phonograph or a tape recorder with a high noise level, and you'll see these principles in operation. Over a period of time listener fatigue multiplies, until finally there is an irresistible impulse to turn the machine off—even though there has been no specific awareness of the background noise.

Signal-to-Noise Ratio

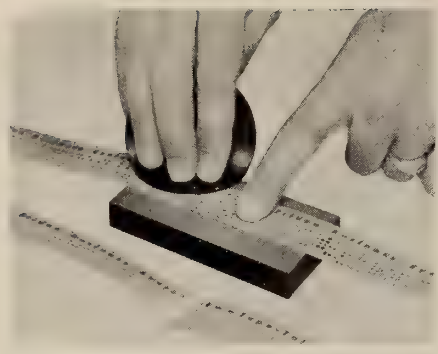
Of course, every machine makes a little noise, even the finest high-fidelity equipment. In judging quality, studio engineers use the signal-to-noise ratio of a machine as a measure. Reduced to its simplest terms, the signal-to-noise ratio is the difference between the loudest electrical signal the machine can reproduce satisfactorily and the electrical noise it produces. It is always stated in decibels (db). The greater the signal-to-noise ratio, the less obtrusive the noise.

In tape recording and playback, most noise is caused by the machine. But some may also be contributed by the recording tape. This particular kind of noise, however, is very easily avoided.

If you want more information on tape recording, you'll be interested in a book called "How To Make Good Tape Recordings." Write for free descriptive folder, Bulletin T, Box AA, Audio Devices, 444 Madison Avenue, New York 22, N. Y.

Unicorn's Tape Splicing Kit

UNICORN Engineering Corp.'s new programming tape splicing kit Model A4809 makes secure and precise overlapping or



The new Unicorn tape splicing kit.

butt splices on damaged or broken tapes in less than one minute. Priced at only $10 complete, the kit includes a splicing block to align the tape for accurate hole location, a supply of pre-punched pressure-sensitive tape for splicing, and a tube of cement for fusing splices. Unicorn is at 1040 No. McCadden Place, Hollywood 38, Calif.

Two New Kalart Film Aids

THE KALART Co. is now offering two new items. First, the Custom 8 dual-purpose splicer for simple editing and repairing of 8-mm film and using either new pressure-sensitive adhesive tapes or conventional cement. It has sprocket-hole guide pins on top which hold the film precisely at the frame for fast butt splicing with tape.

For cement splices there are provided scissor-edged plates which make clean cuts for an overlap splice and a floating-action scraper which quickly removes the emulsion. Price: $4.95.

The second new item is the Craig "Pro" rewind for 2000-foot reels of 16-mm film. Featured is a spring device which automatically disengages the crank when not being turned, thus preventing "flywheeling." A tension brake and locking device provide full control when winding or rewinding. Other features include large wooden handles and counterbalanced crank. Price: $18.50 per pair.

New Kodak Color-Slide Data

"Some Sources of 2 x 2-Inch Color Slides" (S-2), a twelve-page pamphlet, providing an up-to-date list of producers and distributors of color slides, is now available in a revised edition from Eastman Kodak. Listed are fifty-eight firms in the United States, Alaska, Hawaii, Cuba, Mexico and Norway grouped according to the general type of slides provided by each firm. The address of each firm is given along with more specific information on the slides available.

Free copies are available from Sales Service Division, Eastman Kodak, Rochester 4, New York.

"Stereo": What it is and What it Does

The third and concluding article in a definitive series on stereophonic sound; prepared by Fairchild Recording Equipment Corp., 10-40 45th Ave., Long Island City, N.Y.

HAVING defined the nature of stereophonic sound, we may now consider those factors relative to the selection and utilization of equipment used to reproduce it. In essence, the equipment required for stereo are two amplifiers (and preamplifiers if separate ones be used) and two speakers, in addition to a stereo pickup. But this is not the whole story.

If you already have a single channel system, you will require only a pickup and a second amplifier and speaker channel. This will give stereo sound, even if the quality of the second channel is not the equal of the first channel. If you have no system at all, you can buy a two-channel system.

Some people are already using two channels for AM-FM stereo or for tape stereo. All that is necessary in such cases is a stereo pickup and, possibly, a stereo preamplifier, since most tape preamplifiers will not work with phonograph pickups. The power amplifiers and speakers will work just as well for disc stereo as for any other stereo, of course.

Questions Commonly Asked

Following are some of the questions most commonly asked regarding stereo reproduction:

Must the second channel be of equal quality with my first channel, or can I save money and still obtain stereo results?

Always remember that plugs and jacks are conductors of a possibly lethal medium (electricity) and require careful handling so as to not wrench leads or split wires which cause "shorts" and can interrupt a showing or, more serious, occasion severe physical injury.

Extensive experiments indicate that while it is possible to obtain stereo effects with a poorer second channel, the overall effect will certainly not be as good as with two good channels.

Having one moderately good channel which I was planning to replace with better equipment, should I now buy a second channel of equal quality in order to achieve "match", or should I buy the best second channel I can afford?

Buy the best possible second channel even if it be better than your present equipment. If later you can afford a further investment, then the other channel may be upgraded.

Must I buy equipment of the same make for my second channel?

No. As long as the second channel is of comparable quality to (or better than) the first, it matters not what make it is.

Vital Equipment Facts

What are the important facts to be considered in buying stereo equipment, such as pickups, for instance?

The important characteristics of all stereo equipment are the same as for monaural equipment, except that in most cases stereo should be of better, rather than of poorer, quality. For instance, high compliance is important in LP cartridges; it is even more important in stereo cartridges. Low distortion is also of great importance, and so is good tracking ability (the ability of the cartridge to follow faithfully every complex motion of the groove).

There are additional requirements, such as channel separation. For excellent stereo results, about 15 db of rejection between channels is required (talk of 40, 50 or 60 db separation is unrealistic and, fortunately, entirely unnecessary, and may be credited to the gyrations of advertising brains rather than engineering ones). This separation should be maintained over the entire frequency response range, however, and this is less easy to achieve.

It may be that *at some frequencies* higher separation may be attained, but the figure given should be maintained at all *audible* frequencies. On the other hand, wide frequency range is not so important in stereo, and very good results can be obtained with a flat response to 10 or 15 kc.

The Source of "Rumble"

What about turntables? What about rumble?

Rumble is a problem with all disc reproduction. Rumble is nothing but

mechanical vibration of the moving parts of the turntable transformed into sound by the pickup itself and heard through the loudspeaker. An important difference between good and poor turntables is the amount of rumble.

With stereo, both lateral (conventional) motion of the stylus and vertical motion will produce output, hence if there is vibration in both directions in a turntable it will be more noticeable with a stereo pickup than with most LP pickups. Manufacturers of cheap stereo pickups which have no separation between channels at low frequencies sometimes claim this is an advantage with regard to rumble.

Statements that a certain pickup "has no rumble" are something like claiming a horse to be better than an automobile since a horse uses no gasoline. Of course the pickup "has no rumble." The turntable has. But if the cartridge is capable of picking up a signal it will also pick up the turntable vibration.

Here, as always, you get what you pay for. A cheap table will have more rumble than a good table; a cheap pickup will likewise produce more distortion and poorer separation of channels than a good one.

How many wires are needed?

There are four wires from a stereo pickup cartridge, but in some cartridges the four are reduced to three, since two of the wires are ground leads. This means two, not four, conventional cables from the pickup arm instead of one, since each phonograph lead contains two conductors—the signal wire and a braided shield around it. Two plugs are needed, one for each preamplifier input.

Balancing levels between channels.

This must be done by ear to obtain the best effect. It is useless to try to set level by use of separate meters or other indicators for each channel, for the obvious reason that the channels will mostly have different levels on them, and also the speaker and amplifier may be different.

The best way to set level is to play a lateral recording with the stereo pickup and to adjust for equal volume from each loudspeaker. After that, everything played back would have approximately the same balance as originally recorded. Personal preference may dictate slight changes in balance, just as is now done with adjustment of tone controls, but the starting point should be equal speaker output for equal recorded signal.

In practice this is not very hard to achieve by ear, but it is a great advantage to have the two channels fitted

with an overall gain control so that the entire sound output may be adjusted without losing the desired balance between channels.

[NOTE: Fairchild will be glad to answer any question anent stereo reproducing equipment or technique. Address as indicated at beginning of this article.]

New B. & L. Descriptive Index

Bausch & Lomb Optical Co. has made it easy for persons interested in optical equipment to select the exact catalog to fit their informational requirements. "Optical Products" is a 24-page illustrated index which lists current B. & L. catalogs. It is divided into specific product classifications, corresponding to the company's major product divisions. This permits catalogs of allied products to be grouped together for quick reference. Each entry includes a cover illustration and brief descriptive data. A factual account of the contents is included and each catalog number is specified.

Product Index a Feature

A product index in the back of the book permits selection of the proper catalog by product reference. A copy can be obtained from B. & L., 635 St. Paul Street, Rochester 2, N. Y., specifying Catalog L-86.

Disclaimer by R. A. Mitchell

To the Editor of IP:

I wish to emphatically disclaim the authorship attributed to me in Allison Albee's letter (IP for February, p. 12) anent preheating projection lamps. In fact, I could not accept such suggestions when they appeared in IP for December last because I felt they were not practical.

Filament Determining Factor

I used to operate Powers projectors fitted with 30-volt, 900-watt bulbs many years ago. These were preheated by means of a lever which contacted a tapped primary winding in the step-down transformer. The preheating process was undoubtedly much more beneficial with 30-volt bulbs (which have comparatively heavy filaments) than it is with 120-volt bulbs for 16-mm projectors.

I have used such lamps under various conditions for a number of purposes; and my own observations confirm Mr. Albee's opinion.

Robert A Mitchell

Canadian Movie Seating Capacity

Canada now has 844,439 seats available in roofed theatres for the showing of 35-mm film attractions. Added are 240 drive-in theatres with a total car capacity of 92,423. The nine legitimate theatres, some of which play films, had 9,785 seats and 725 walk-in seats.

These figures represent a decline of 12% in the six years since Canada started its own TV production; while the number of theatres declined by 18%.

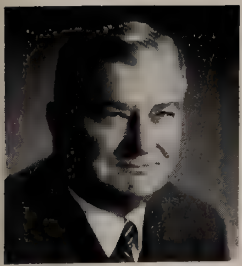
Kodak 1958 Sales, Earnings

Total sales and earnings of the Eastman Kodak Company for 1958 were higher than for 1957, and the sales and earnings outlook for 1959 appears "favorable." Consolidated sales of the company's United States establishments last year amounted to $828,801,269 about 4% more than the $798,283,443 for 1957, the best previous year.

Net earnings of $98,912,039, or $5.13 per common share, were slightly above the 1957 total of $98,108,305, or $5.09 per share.

McKinney Promoted by NTS

Henry J. McKinney has been named eastern district supervisor of National Theatre Supply Co., announces W. J. Turnbull, president. He will continue to act as branch manager of the Boston office in addition to his new duties. The eastern district of NTS includes Albany, Baltimore, Boston, Hamden, New York and Philadelphia. McKinney joined NTS over 30 years ago in the company's southern district engineering dept. in Atlanta, Ga.



National Theatre Supply's Henry J. McKinney

He served in various capacities in the Dallas, Chicago and New York branches prior to being made Manager of the New Haven office.

In 1935, McKinney was made Manager of the Boston branch, a post he has held since. He will continue to reside in Chestnut Hills, Mass.

Stereo For All Fox Films

Complete use of the full qualities of stereophonic sound in CinemaScope motion pictures—with particular emphasis on the "surround" or fourth sound track on each piece of film has been announced by 20th Century-Fox.

Pointing out that more than one-third of the nation's theatres have C-Scope equipment and full four-speaker sound systems, 20th-Fox said that *all* its forthcoming releases will take full advantage of the surround strip for background scores, special sound effects and off-stage atmosphere sounds.

OBITUARIES

SPEARING, JOHN N., 59, IA representative, died March 3rd of a heart attack at St. Vincent's Hospital, Jacksonville, Fla. A charter member of Jacksonville Local 511, he held the office of business representative since 1920. In 1930 he began representing the International on special assignments throughout Florida.

Spearing was a former member of the Jacksonville Civil Service Board, the City Pardoning Board, and the City Housing Committee. He served as president of the Jacksonville Central Labor Union, the Florida Civil Service Assembly, and as vice-president of the Florida Federation of Labor.

Survivors include his wife and four children.

• • •

MARSDEN, THOMAS, member of Toronto Local 173 for 47 years, died suddenly on February 17. A charter member of the Famous Players 25-Year Club, he was chief projectionist at the Imperial Theatre in Toronto for 39 years. He was a member of the Canadian Picture Pioneers and of the Metropolitan Lodge, Masonic Order.

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McINCROW, FRANCIS J., 60, member of Local 228, Toledo, Ohio, was stricken with a heart attack an January 25th last while working in the Gayety Theatre there and died several hours later. Originally a member of Local 576, Mansfield, Ohio, he transferred to the Toledo Local in October 1948.

"Why Exhibitors Steal" *(And We Quote)*

Occasionally there is a bit of soul-searching by the exhibitor forces which, glory be, are not concerned with the avarice of Labor Unions. The appended tidbit, penned by our friend Jay Emanuel, publisher of "The Exhibitor," may, but shouldn't, shock you—even under the heading cited above:

. . . A case in point is a soon-to-be-released important cartoon feature, the terms for which are being quoted at "90-10, with a 60% floor." Another way to say this is: "We want 90% over actual audited house overhead plus advertising costs, *BUT* in no case will we take less than 60% of the gross, even *if you do not get back your actual audited house overhead plus advertising costs.*"

Suppose that a given theatre has a $3000 overhead and that on a given picture it spends $500 over and above its regular advertising, for a total of $3500 out of pocket. On this picture it grosses $12,000. So it gets back the $3500 it has laid out, plus 10% of the $8500 remainder, or a total of $4350 (36¼%); while the distributor gets $7650 (63¾%). But what if, in this tricky market, a fairy-tale cartoon does not do $12,000, but even at the *demanded* admission price increase does only $8000?

Design for Theatre Closings

At an $8000 gross, on the same quoted "90-10 with a 60% floor," the distributor is always going to get a minimum of $4800 (60%). That leaves exactly $3200. Where is the exhibitor to go for the $3500 he laid out, or for his 10% of the profit on the engagement "partnership?"

So the gimmicks and "floors" that strive for "the edge" only make bad customers out of good ones, and reflect on the avarice and amoral thinking of the seller. Maybe two wrongs never made a right; but one wrong has certainly made another. Another, and possibly more evil one!

Drive-In Equipment Ills Are Cited by Exhibitor

"Much more light is needed on drive-in theatre screens, and the failure to provide it ruins a lot of good pictures," said Hugh McLachlan, chairman of National Allied's equipment and research committee, in a report to the recent convention of the drive-in meeting. He said also that much difficulty was being experienced as a result of "ambulatory light" from sources outside the drive-in enclosure.

"Many prints are being ruined by improper 'foxhole' sprockets," McLachlan continued. He also said that while there are a lot of good outdoor screen paints, "there are no 'miracle' paints."

NCC's New 7-mm Carbon

A new positive projector carbon that gives more light and lasts up to 20% longer than previous carbons in its ampere range is available from National Carbon Co. An outgrowth of continuing research and development in projector carbon materials and processing techniques, the new "Suprex" 7-mm positive carbon is designed for use in the 40- to 55-ampere range.

Projectionists' Elective

Operating satisfactorily over the entire current range, the improved 7-mm positive carbon has a maximum rating 5 amperes higher than the previous 7-mm carbon, providing even more light for today's larger motion picture screens. Projectionists have the option of getting up to 20% more light from the new carbon, or of operating it at approximately a 20% slower burning rate than the previous 7-mm carbon at its maximum current of 50 amperes.

The new "Suprex" 7-mm carbon is now available from theatre supply houses throughout the country.

SMPTE Miami Beach Meeting

The 85th semi-annual convention of the Society of Motion Picture & Television Engineers will be held May 4-8, inclusive, at the Fontainbleau Hotel in Miami Beach, Fla. Concurrent with the technical sessions will be the largest equipment exhibit—and the first with extensive international participation—ever sponsored by the SMPTE.

On the first day of the convention, a session on Motion Picture Theatres and Projection will deal with problems in an area that has become complicated, according to industry leaders, by the introduction of new methods and processes.

Form All-Industry Group—TESMA

Thomas LaVezzi, president of Theatre Equipment and Supply Mfrs. Assoc., and also president of LaVezzi Machine Works, announced TESMA's desire for an overall film industry committee of executives from the boards of directors of every group therein, from the producer to the exhibitor. All industry problems would be studied by this group, with particular reference to projection standards in theatres.

Drive-in Theatre Statistics

The latest survey of drive-in theatre attendance reveals that 4,541 drive-ins—95% of the total—are now available for screen advertising, the Theatre-screen Advertising Bureau reports. The survey, including communities of every size, was concluded in late 1958. Average weekly attendance figures for the drive-ins reached 19,835,400 in those theatres, the survey showed.

Increased ad coverage is due to two major factors: increased acceptance of filmed commercials as viewers become used to them on TV, and the fact that film product quality has increased considerably. Previous studies have shown that approximately 80% of the drive-in audience is married and has a high school or better education. Average drive-in has a capacity of 400 cars.

Projector as Integral Opt.-Mech. System

(*Continued from page* 13)

steps through his professional societies to relieve himself of the problem he now faces in choosing projection equipment. To illustrate the need for centralized research into the requirements of projection equipment, let us consider just one component of the projection equipment, the projection lens.

In line with the current demand for more and more screen illumination, the idea of using faster projection lenses certainly is an attractive one — at first glance, at least. But putting this idea into practice introduces a host of new problems. Let us consider just a few.

(1) *Resolution Performance.* Because the higher-speed lens is inherently more difficult to correct in the design stage and more difficult to produce in the manufacturing stage, a general lowering of resolution performance is to be expected of higher-speed lenses.

(2) *Image Contrast.* Like resolution performance, image contrast can be expected to deteriorate. Getting more light through the higher-speed lens is one thing, but being able to design and manufacture the lens so that the added light is properly directed is something

else. Unless the added light is properly directed, we might just as well increase screen illumination by turning on the theater lights.

(3) *Uniformity of Screen Illumination.* Uniformity of illumination over the projected picture area is dependent upon the total vignetting which occurs both in the projection lens and in the illumination system. Increasing the speed of the projection lens alone will not produce a uniform increase in illumination over the whole picture area. To accomplish a uniform increase may require a change in the illumination system which the manufacturer is unable to make.

(4) *Depth of Focus.* We shall use the term depth of focus in its usually accepted sense of being the distance along the lens axis through which an object can be moved forward or backward without causing a detectable change in focus of the image of that object. Its practical importance is that it is indicative of how much film flutter or buckling can be tolerated in a given projection system. Thus:

$$\text{Depth of Focus} = \pm 0.000043 \times (\text{F/number})^2 \text{ inch}$$

For comparison purpose, we list the depth of focus for several lens F/numbers.

F/Number	*±Depth of Focus, inch*
2.5	0.00027
2.0	0.00017
1.8	0.00014
1.6	0.00011
1.4	0.000084

We note that going from F/2.5 to F/1.8 effectively cuts the depth of focus in half, and that at F/1.6 the depth of focus is reduced to just about five wavelengths of light.

(5) *Alignment of the Projection Lens With the Film Plane.* It follows that as the depth of focus *decreases* with *increased* projection-lens speed, the alignment of the optical axis of the projection lens perpendicular to the plane of the film gate becomes increasingly critical.

(6) *Speed of the Illumination System.* This, too, becomes more complex with increasing projection-lens speeds, as will be illustrated further along.

Lens Only One Component

These are but a few of the many factors which it must be recognized influence overall performance and which are affected by the choice of the projection-lens speed. Considering the fact that the projection lens is but *one component* of the projection system, it is quite apparent that a list of all the known factors of *all* the components contributing to the overall performance will be quite an imposing one.

Moreover, it is quite apparent that the interdependence of the performance of one component upon the performance of one or more of the other components necessitates the evaluation of *each* component with respect to its performance *in the system*, rather than its performance as an entity.

With these problems in mind, how shall the projectionist make his choice? We have said, for example, that we can increase screen brightness at the expense of image contrast, but what should the compromise be? The same question applies to brightness and resolution.

We have shown that depth of focus *decreases* with increased lens speeds. From experience we know that we cannot, nor do we have to, focus the projection lens to quite the precision indicated by the theoretical values, but we do not know at what point depth of focus does become the limiting factor in image quality.

Diverse Factors Involved

We know that we can change the brightness distribution on the screen by varying the speed of the illumination system; but do we know what the relationship should be between the projection-lens speed and the illumination-system speed from an overall consideration of brightness distribution, film buckling, cost and convenience of size of the lamphouse?

How can we get the answers to these problems? Certainly they will not come from the manufacturers involved *because the manufacturers have little or no incentive to solve the problems.*

Piecemeal advances in projection equipment will, of course, continue to be made, as for example, the recent introduction of the "cold" mirror. But even in this case, maximum utilization of the cold mirrors requires certain changes in the lamphouse over which the cold-mirror manufacturer has no control.

It is the fact that the optimum designs

for the various projection situations will require compromises in every component of the system that discourages the various manufacturers, *acting as individuals*, from finding the needed solutions.

Projectionist Action Urged

This is the reason why the suggestion was made that the projectionist, through his professional societies, conduct centralized research into these problems and establish specifications for the equipment which best suits his needs. In today's competitive market, the manufacturers will have no choice but to supply these needs.

[TO BE CONTINUED]

PROJECTION POT POURRI

(*Continued from page* 11)

ing wide screen is not beginning to look rather old-fashioned in shape? The cropping necessary to take it to 2:1, the minimum for fashionable acceptance, is altogether too severe to stomach permanently, representing as it does a waste of 45% of the running footage, as already stated.

There are more than 50 million TV sets in the U.S. and, to the manufacturer's woe, it has been discovered that they have an average life of 5 years. Saturation is around the corner. Color TV, thanks be, cannot yet get off the ground. But there is one thing that can sell a whole generation of new sets—a panoramic TV picture. This is not so difficult of accomplishment and it can be compatible. It will be wide-screen shape. Still feel we can hold to it in our movie houses?

Converting Existing Projectors

My solution would be to convert existing projectors to 3-tooth pulldown and full width frame. The 3-tooth pulldown represents a 0.561-inch frame height. A frame-separating bar easily could be accommodated in 0.038 inch, such as CinemaScope, leaving a camera frame height of 0.528 inch and a comfortable projector frame height of 0.500 inch.

If the frame is taken out to the edge of the perforations (especially with "foxholes") a picture width of 1.000 or even 1.025 inch can be established. At once there is a frame area of 0.500 square inch which, while not breathtaking, is certainly far better than any existing wide screen area (2:1 and 1.85:1 are respectively 0.340 and 0.368 square inch).

With any picture width of 2:1 or greater, the 4-tooth pulldown cannot, at any time and under any conditions, produce a greater frame area than the 3-tooth, thus making the 4-tooth redundant except to play existing films. This leaves two standards for projector aperture: 3-tooth and 5-tooth with about the same picture ratio in each case.

Two-Track Stereo Sound

My system envisages two soundtracks, both outside the perforations and in stereophonic form. Today it will not be difficult for even the layman to know that 2-channel stereophonic sound is going to be the "done thing" of the future. Is the public going to learn to say, "Oh, you mean the movies with steam sound"? And just because we made one attempt at stereo which did not come off?

The thought of 3- or 4-channel stereophonic sound actually makes little sense because it seems to gild the very object of stereophony. It does, however, present the sound over a broad front, which has distinct advantages in a wide theatre.

It is interesting that present planning in the disc industry makes the standard

1/4-inch wide pre-recorded tapes carry four side-by-side tracks, and probably magazine loading. The object is to bring the price and convenience of tapes into line with discs. What interests us is that four separate tracks, meaning five separating spacing gaps and four soundtracks can be put into 1/4 inch, or 0.250. It is probable that the signal-to-noise will be slightly increased, but overall quality will be better than disc.

The width between 35-mm perforations and film edge is 0.086 inch for "fox-holes" and 0.079 inch for standard holes. It is worth observing that four of the six soundtracks of 70-mm Todd-AO are outside the perforations.

Substantial Gains Realizable

In this way the industry, both studios and exhibitors, would gain a substantive commercial advantage of 25% reduction in film footage for the same audience running time. Coupled with this, a gain in projector aperture area of 47% as compared with 2:1 and 36% for 1.85:1 in wide screen. Reel loadings would drop 25%, so that the obvious ideal of one fully automatic projector, loaded up with a whole program, could draw nearer.

Do I hear somebody say, "What about rewinding?" It seems that we are inevitably approaching separate and distinct performances. The refreshment intervals? Just right for rewinding.

My plan will have the criticism that the projectionist will have to cope with 5-tooth, 4-tooth and 3-tooth pull-down. If the projector manufacturers solve a quick changeover for one, the problem is pretty nearly solved for the other. After all, projectionists now have to change aperture plates frequently, and an appropriately designed system changing the sprockets and gate position need not take much longer.

Maintaining the pitch line of the intermittent sprocket tangential to the gate, for all three of the apertures, should not be impossible of solution; in fact, I have devised several methods.

Multiple Philips Lamp Unit

The new Philips light source is attractive from the point of view of light efficiency passing through a rectangular aperture. In the square aperture used in 5-tooth pull-down, it might therefore be necessary to slip in an auxiliary vertical cylindrical lens, but I have insufficient knowledge of the optical system to be sure of this. The point is that the light source and ray being so tiny and the light virtually "cold", this need not be expensive.

It will not be of great interest to the large theatres, as they cannot begin to take this new lamp seriously (or Xenon for that matter) until they can produce 10,000 or 12,000 lumens net, however efficient the screen may be. For the large and super-duper theatre, I am vastly intrigued at the thought of the new miniature Philips lamp as a multi-lamp unit, a bunch of them ganged together, rather on the lines of a compact filament incandescent lamp. I see nothing against it—fabulous!

For the medium and small theatre, the merits of these new lamps cannot be left out of consideration, by management or engineers.

Screen Performance Data

As for screens, obviously the higher the gain, consistent with a desirable polar curve, the less the number of lumens called for from the lamp. Almost as important in a screen is its contrast ratio—which means the difference between the darkest darks and the lightest lights.

Yet a third and vital factor in a screen is its capacity to reject stray light. Quite a small quantity of stray light will absolutely "murder" the darks and all colors will be degraded. A matte white is at the very bottom of the class in this, a narrow theatre lenticular silver at the top. Pearl is almost as bad as a matte white, although careful manufacture can reduce this. This factor is deadly also in the case of extreme curvatures: the higher the acceptance of stray light, the greater will be the quantity of light the screen will reflect back onto itself and so destroy the contrast.

If this article does nothing more than set you thinking, then it will partially have served the writer's purpose.

CINEMASCOPE: KEYNOTE OF MODERN PROJECTION

(*Continued from page* 6)

having only one speaker assembly behind the middle of the screen.

"Bastard" Unit Setups

Just as anamorphic lenses and projection lamps have been improved in recent years, so have theatre loudspeakers. Imagine using today a bastard system which was "modernized" ten or fifteen years ago by the addition of a dynamic "woofer" to a 1929 exponential horn unit! In fact, speakers as late as 1950 are now hopelessly obsolete. Their response is usually so "peaky" that they have a characteristic tone (?) often described as "hollow," "tinny," "wooden," etc.

Summarizing: trade press and general newspaper talk about "great" and "blockbuster" pictures *as to content* means nothing if that content be mangled, either visually or aurally, by inferior projection equipment or technique.

Re-evaluate your projectors, lamps, lenses, screens, and sound equipment, measuring their capabilities *in terms of C-Scope quality*. Examine the screen results and sound quality in other theatres. If you find that other theatres give a better show, ascertain the reason therefor; then "talk turkey" with your management—and keep on talking.

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R. ENTRACHT, *Publisher*

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Monthly Chat

That Ephemeral Projectionist Society

CHEMISTRY is an exciting science which in practice often yields wholly unexpected by-products. But language—the chemistry of words—also yields unexpected fruit. Testamentary to this thought are the articles entitled "Viewing the Projector as an Integral Optical-Mechanical System," by Harold E. Rosenberger of Bausch & Lomb Optical Co., now current in these pages.

Unwittingly, the learned Mr. Rosenberger touched a nerve center of craft operation when, in discussing the non-integration of the projector, he wrote: "We suggest that the projectionist take steps through his professional societies to relieve himself of the problem he now faces in choosing projection equipment. To illustrate the need for centralized research into the requirements of projection equipment, let us consider just one component of the projection equipment, the projection lens."

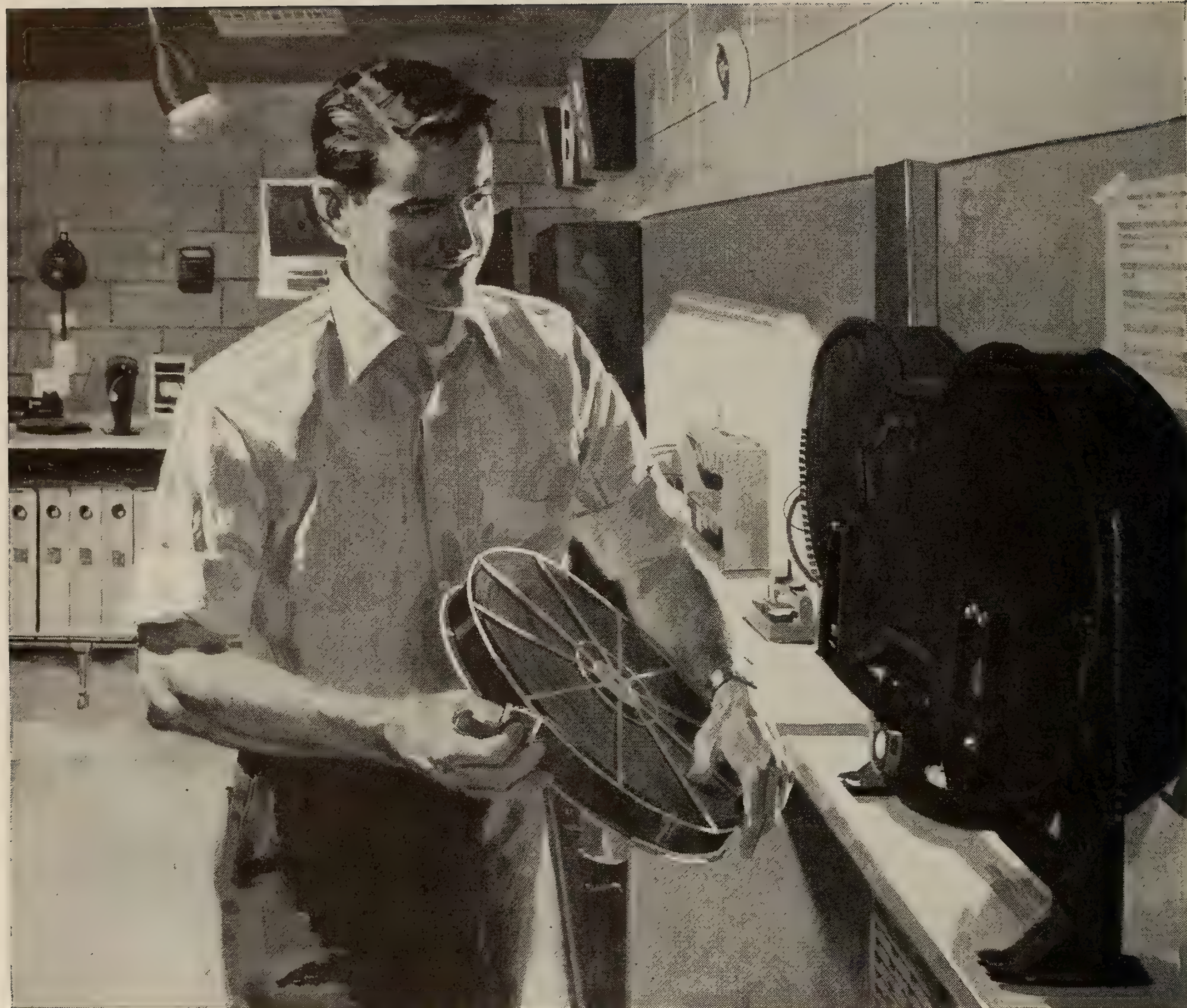
Now, this is a perfectly reasonable and wholly rational grouping of words—except for one thing: there is no such society. True, there exist professional societies which interest themselves in matters bearing upon the reproduction of picture and sound. But so conglomerate are the applied arts which enter into the audio-visual process that by the time these data are presented in the journals of these reputable, and often stuffy, "engineering" societies, the end product of such activities is so diffused as to be of little practical worth at the transmission (projection) level.

Unquestionably Mr. Rosenberger wrote the aforementioned words with the best will in the world, but it would require a long lingering look over his shoulder to discern even a trace of any such "projectionist professional society." We who have been active in the projection field for 35 years, will recall the existence of such organizations: The American Projection Society and, subsequently, the Projection Advisory Council. But to label these groups "organizations" would be a misnomer because what they actually were was merely a grouping of *individuals* who, however sincere, could not possibly hope to effectuate the aims so loftily expressed in their articles of organization. The reasons for the ineffectiveness of these groups are many, the salient one being that which is reserved to the knowing.

A moment's reflection will occasion no little wonderment as to how a group of craftsmen some 20,000-odd strong could engage in so exacting a practice as the transmission with fidelity of both image and sound to millions of critical viewers daily. Here we have a craft to which machine tolerances of 1/10,000th inch have been commonplace for the past 50 years —long before the automobile industry even gave thought to such precise production.

It is a constant source of amazement to innumerable non-craft personnel how a group of men can deal successfully day in and day out with such trifles (?) as 6-track magnetic sound reproduction, a variety of aperture plates, varying screen sizes, high-intensity arcs ranging up to 180 amperes, high-speed lenses—the list grows long but is nowhere near its end—without the benefit of a centralized source of ready technical data. Perhaps the saddest commentary on the situation is that a nation-wide exhibitor organization, their employers, literally had to beg for craft cooperation in effecting an improved performance level.

If the cows in the meadow elected only to chew on their cuds and ignore the grass, there soon would be no milk.—JAMES J. FINN



INTERNATIONAL PROJECTIONIST

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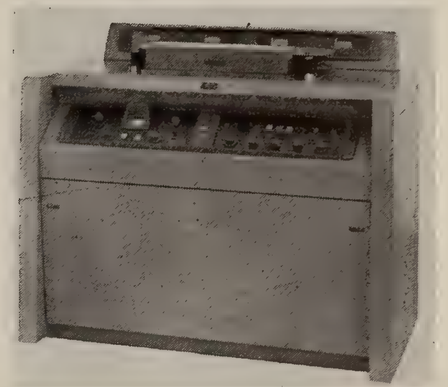
THE VIDEOTAPE* RECORDER

By GEORGE B. GOODALL

Ampex Corporation



This is the first in a series of articles describing the Ampex Videotape equipment which is revolutionizing television programming. Recording pictures on magnetic tape is a complex process, and this initial discussion lays a foundation for the articles to follow.

I. BASIC PRINCIPLES OF MAGNETIC RECORDING

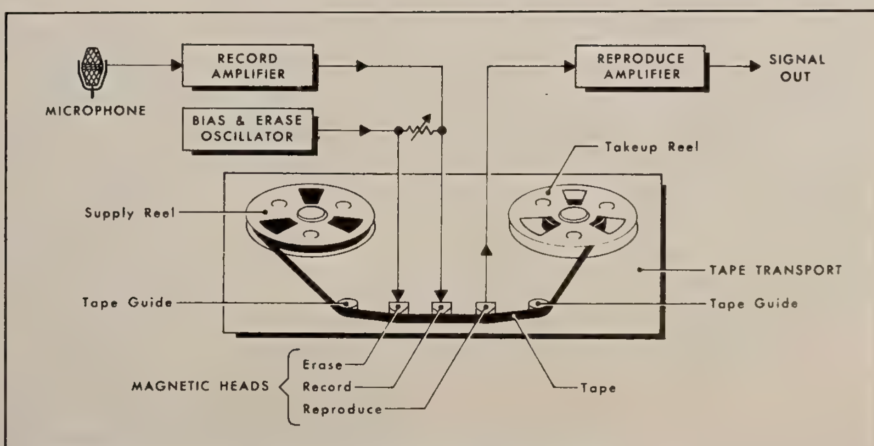
IN APRIL, 1956, Ampex Corporation unveiled probably the most sensational magnetic recording equipment ever developed—the Videotape* Recorder. This machine makes it possible to record both sound and picture on tape, and has thus ushered us into the age of magnetic photography. It is the Videotape equipment which will be our main interest in this series of articles. However, even a very general outline of the principles involved in the video application would be worthless without at least a superficial knowledge of conventional magnetic recording theory. Therefore, the first two discussions will concern normal audio recording on magnetic tape with particular emphasis on those characteristics which will be important in later discussions.

Let it be understood to start with that you are not going to be bored by the long, drawn out discussion of the history of magnetic recording which is the seemingly inevitable preface to any attempt to explain the basic theory of this process. But it seems pertinent to point out that the first patent on a magnetic recording device was issued some 60 years ago, and it was originally anticipated that its main use would be in the telephone and telegraph industries. So magnetic sound is not a recent innovation, conceived by some diabolical genius solely to complicate life in the theatre projection room.

It is also interesting to note that probably the first magnetic recorder to use tape (steel tape, that is) instead of wire as the recording medium was developed for a motion picture application. About 1920 a British producer named Louis Blattner acquired patent rights to manufacture magnetic recording equipment for use in the entertainment field. His machine, the "Blattnerphone", supplied synchronous sound for some of the first talking pictures in England.

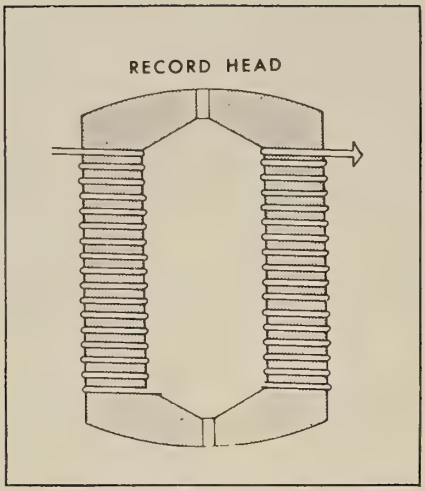
Why Magnetic Tape?

There are many advantages to recording on high quality magnetic tape using professional grade equipment. No other device can offer comparable fidelity of reproduction. Tape provides the convenience of immediate playback without processing, and the economy of being able to erase and re-record. It furnishes a large storage capacity in a minimum space. Technically one of its greatest attributes is the gradual overload char-



These main components of a magnetic tape record/reproduce system are discussed herein.

* Trademark, Ampex Corporation.



This diagram illustrates the construction of a magnetic head.

acteristic which exacts a minimum penalty for slightly incorrect record level adjustments. Audio recordings can be stored indefinitely or replayed thousands of times with no deterioration of signal. And tape still is the only practical means of producing professional quality stereophonic sound where more than two channels are involved.

BASIC COMPONENTS OF A MAGNETIC RECORDER

A quick review of the components of a magnetic recording system will aid in our understanding of the record and reproduce processes. It will point out some of the principles involved, and the precise assembly techniques necessary for professional quality equipment.

MAGNETIC TAPE: Modern magnetic recording tape consists of myriads of minute iron oxide particles suspended in a synthetic resin binder and deposited on a plastic backing. The iron oxide material is of course the actual magnetization medium, and it is very important that it can be distributed uniformly on the face of the tape. (Other characteristics necessary for television tape will be described when we discuss the video application.)

MAGNETIC HEADS: No assembly in a magnetic recording system is more important than the heads, which convert electrical current to a magnetizing force during the recording operation, then reconvert that magnetism to an electrical current during the reproduce mode. As we shall see later, the heads are the primary limiting factors in determining the frequency response of a system. Professional quality equipment employs three separate heads—erase, record, and reproduce—each specially designed to perform its specific function.

The Recording Head

The operation of the record head is essentially the same as that of an electromagnet. If we insert a core of permeable material within a coil of wire, then run a direct current through that wire, we can set up an intense magnetic field that will attract any nearby material which is capable of being magnetized. If instead of the direct current we used an alternating current, we would first attract then repel that material (at a rate controlled by the frequency of our a-c) until it assumed a position that was neutral in respect to the alternating field.

In a magnetic recording head the core is shaped like an incomplete ring—the discontinuity forms the head "gap"—with a coil of wire wrapped around it. When the signal to be recorded is converted to an electric current and passed through the coil, a strong magnetic field is created across the gap. If we now pass our magnetic tape across the gap, the metallic particles in the tape will assume a magnetic pattern which is a function of the instantaneous magnitude and polarity of the original signal.

The Reproduction Head

Although the reproduce head is constructed almost identically the same as the record head, its operation is fundamentally different. This head functions more like an electric generator. When we move a conductor through a magnetic field, as we do in a generator, we induce in that conductor a voltage whose amplitude is a function of the magnitude and direction of the magnetic flux and the velocity with which the conductor cuts through the field. We can, of course, achieve the same results by passing the magnetic field across a stationary conductor, as the only requisite is that the conductor must cut the lines of force.

(Note here that, assuming a constant field, the amplitude of the induced voltage is dependent upon the speed with which the conductor cuts the lines of force; this is an important factor in the low-frequency response of a magnetic recording system.)

Similarly, when we move the recorded tape past the gap in a reproduce head the magnetic flux on the moving tape will induce a voltage in the head coil, just as happened when we moved the magnetic field across the conductor in our generator. This induced voltage will be proportional to the number of turns of wire on the head coil, the permeability of the core material, and the time rate of change of the magnetic flux.

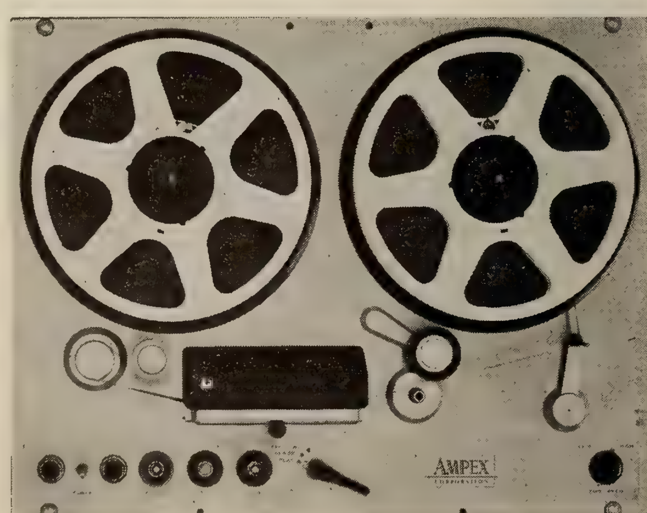
Assuming a constant tape speed across the head, the last factor means that the output of a given reproduce head will increase directly with frequency (as frequency rises the recorded wavelength of the signal on the tape is shorter, resulting in a greater rate of change of flux across the head gap for a given tape speed).

The Tape Transport

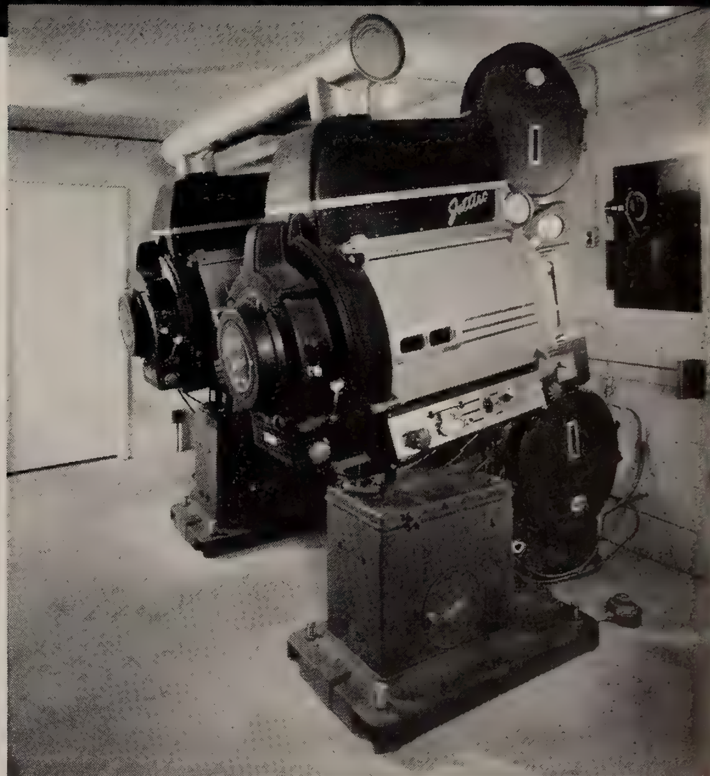
The function of the tape transport is to move the tape accurately across the heads at a precisely constant rate of speed. We can consider that all tape transports consist basically of three major divisions—first a tape supply system, then a tape drive system, and finally a tape takeup system. These divisions can be likened to two reservoirs with a pumping station between them that removes material from one reservoir and adds it to the other.

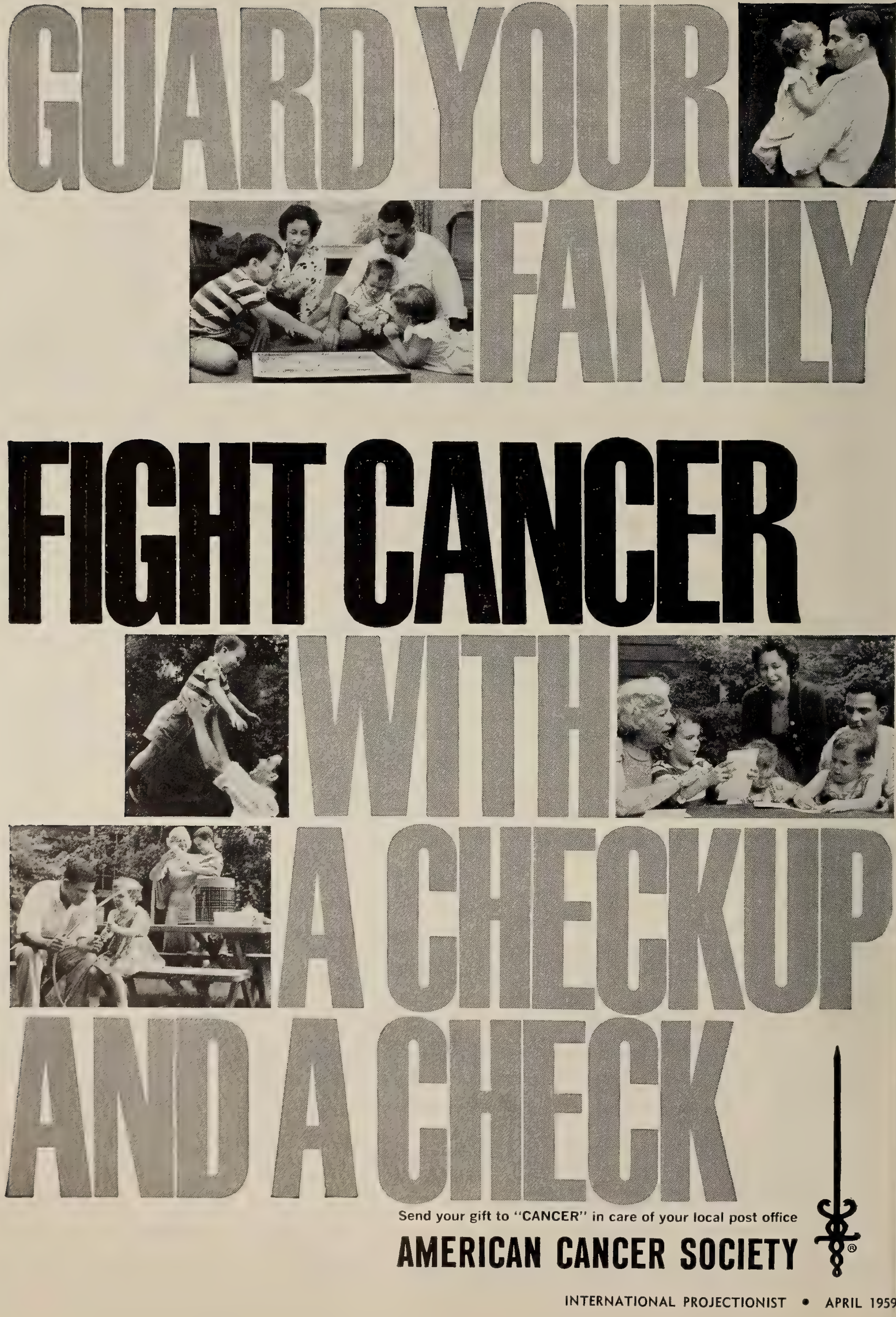
Most professional quality equipment employs three motors, one each for the supply system, drive system, and takeup system; however if weight or volume is important (such as in portable machines) high quality results can be obtained by using one motor to drive the tape and employing mechanical coupling to the supply and takeup turntables.

Usually the tape supply and tape takeup systems can be considered as identical assemblies, with the only probable differences being in the brake band configuration and the connection to the



Shown here is a professional quality tape transport mechanism which is used extensively by recording studios and radio stations.

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power source. Torque motors are used to drive the turntables directly. These motors are connected to rotate in *opposite* directions when power is applied —the supply motor opposing and the takeup motor supporting the normal direction of tape motion.

In the record and reproduce modes these motors act simply to maintain proper tape tension and have no influence on tape motion, which is controlled entirely by the drive system. During this operation the supply motor imparts tension by opposing tape motion, while the takeup motor attempts to turn slightly faster than necessary to wind in the tape from the drive system.

In the fast winding modes of tape travel, the reel motors *do* control the tape motion. Here one motor is operated under full power and the other with reduced power; the greater torque of the motor under full power overcomes the lesser opposing torque and tape is simply pulled from one reel to the other, again under correct tension.

The Drive System

The drive system utilizes a synchronous motor coupled either directly or through a pulley arrangement to the capstan. The circumference of the capstan and its rotational velocity determines the speed of the tape in the record and reproduce modes. It is very important that this speed be constant, because any variation will be reflected as a change in tone of a musical note.

For instance, to consider an exaggerated example, if we were reproducing a sustained 1000-cycle tone at a tape speed of 7½ inches per second and that speed suddenly dropped to 6 inches per second our tone would be reduced to 800 cycles; most musical directors would frown upon this effect. (Of course, this could occur either while recording or reproducing.) Tone variations of this type are called "flutter" when they occur at a relatively high rate, and "wow" when they occur at a relatively low rate. Therefore, we must have a precisely machined capstan that rotates at an unvarying speed.

Head-to-Tape Contact Vital

While tape *speed* is a function only of the capstan, tape *motion* in record and reproduce is instigated when a capstan idler (sometimes called a pressure roller) clamps the tape between itself and the capstan, thus providing a surface against which the capstan can drive the tape. The capstan idler is normally coupled to a solenoid, which in turn is actuated by the play or record switches. This arrangement allows a "fast start" condition in which the capstan motor is operating whenever power is applied to the equipment, and tape can be quickly brought to full speed, whenever the play or record switch is pressed.

Good head-to-tape contact and proper placement of the tape on the heads is extremely important. An inherent characteristic of magnetic tape recording is that the effectiveness of the magnetized tape in producing a high-frequency signal in an ideal playback head varies directly with the distance of the magnetized particles from the head. Thus, any loss in good head-to-tape contact will adversely affect the high frequency response.

If the tape does not track correctly across the heads both frequency response and level will be affected. Two precisely machined and positioned tape guides will thus bridge the head assembly. In professional quality equipment the positioning of the guides will ensure good head-to-tape contact and the machined grooves in the guides will accurately position the tape.

System's Electronic Circuits

There are three main electronic circuits which must be provided—a record amplifier, a bias and erase oscillator, and a reproduce preamplifier. These will normally be quite conventional audio circuits except for certain minor modifications made necessary by the special application.

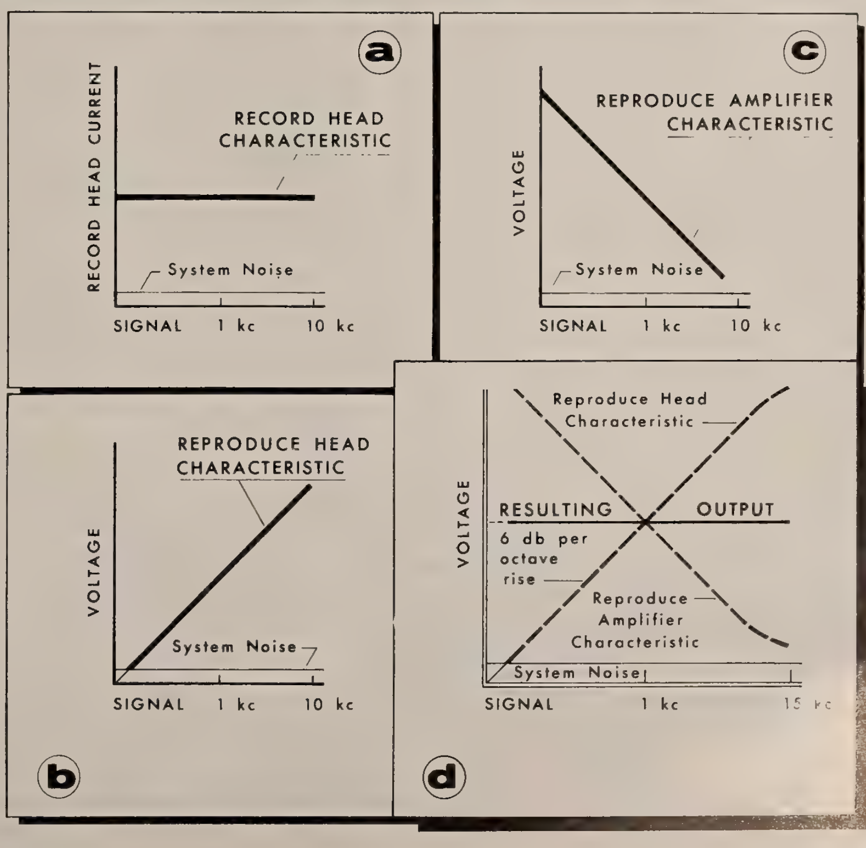
The function of the record amplifier is to present to the record head a signal of proper amplitude for the recording process. The record head is essentially an inductance whose a-c resistance (impedance) will vary directly with frequency. The magnetizing force is directly related to the amount of current which flows in the head coil, so high frequencies would suffer if the rising impedance of the head coil at the shorter wavelengths were allowed to decrease the current flow appreciably. Therefore, the output circuit of the record amplifier will present a relatively high impedance in respect to the head coil, which will now have less effect on the complete circuit; a virtually constant current condition is thus maintained regardless of the frequency involved.

In order to further ensure proper recording of high frequencies the record amplifier might also contain a pre-emphasis circuit which essentially provides more amplification as frequency rises.

The magnetization curve of recording tape is non-linear, and considerable distortion would occur during reproduction if steps were not taken to provide correction. A high-frequency, constant amplitude "bias" voltage is mixed with the audio signal so that operation is obtained on the linear portion of the magnetization curve. (This is basically the same action we take when we employ a d-c bias with vacuum tubes to obtain

(*Continued on page 26*)

Achieving flat overall response necessitates equalization of the reproduce amplifier. This diagram illustrates various record and reproduce characteristics which result in the desired output.



Intermittent Movements For 16-mm Projectors

An Analysis of the Relative Efficiencies of the Various Movements now Being Used

By ROBERT A. MITCHELL

EVEN THOUGH they are lighter, more compact, and less expensive than their 35-mm counterparts, 16-mm cameras and projectors require correspondingly greater precision in the functioning of their intermittent movements. The distance between successive frames on 16-mm film is only 0.299 of an inch, or 2½ *times smaller* than the 0.748-inch frame distance on 35-mm film.

The requirement of greater frame-registration accuracy in all "small-film" motion-picture apparatus has been successfully met by the shuttle-claw movement. Not only is this device extremely simple in construction, small in size, and low in cost, but it tolerates dimensional errors in its manufacture which would be ruinous to the performance of a geneva-type movement. Moreover, the claw movement can be made to work at 5-to-1 and even higher pulldown ratios, permitting the use of small-blade shutters for more efficient light transmission, or, alternatively, for flickerless projection at high light levels.

The great operational accuracy of the shuttle-claw mechanism depends upon the fact that its motions, like the successive strokes of a simple piston, are repeated in exactly the same way with each revolution of its camshaft, as shown in Fig. 2. All sprocket-type intermittents, including the geneva, are at the mercy of the accuracy with which corresponding "indexing stations" of starwheel faces, sprockets, sprocket shafts, etc., are machined.

The acceleration-deceleration characteristics of the "shuttle-yoke" to which the claw teeth are attached (Fig. 1) are somewhat similar to those of a conventional sprocket movement. That is to say, the film-pulldown starts gradually, increases to a maximum velocity, and then decelerates to a dead stop before the claw teeth are retracted from the film perforations.

Claw Velocity, Position

The velocity and position of the claw at any stage of the complete cycle of movements depends in some measure upon the curvature of the "heart-cam" faces and the distance between the heart-cam center and the shuttle post. With a long distance (Fig. 3-A), the movements are rectangular, but with a relatively short distance (Fig. 3-B), the claw "lifts" at the points of engagement and disengagement from the film perforations. A slight lifting action of this kind increases film life.

Professional projectionists do not encounter shuttle-claw intermittents in their theatre work, since 35-mm projectors invariably employ sprocket intermittents. Sprocket movements (such as the geneva, pin-cross, and drunk-cam*) never "miss" the perforations when the film "overshoots," are normally quieter than claw movements, and undoubtedly less damaging to film. However, a few of the older 35-mm projectors, including the Lumière Cinématographe and the early Selig and Pathé projectors, all predating 1910, employed the rock-steady claw movement. The Lumière machine of 1894, a combination camera and projector, is famous as the ancestor of *all* movie projectors.

*Refer to the comprehensive description of sprocket movements by José Ruiz in the following issues of IP: November 1955, p. 13 *et seq.;* December 1956, p. 18 *et seq.;* January 1957, p. 13 *et seq.;* February 1957, p. 26 *et seq.*

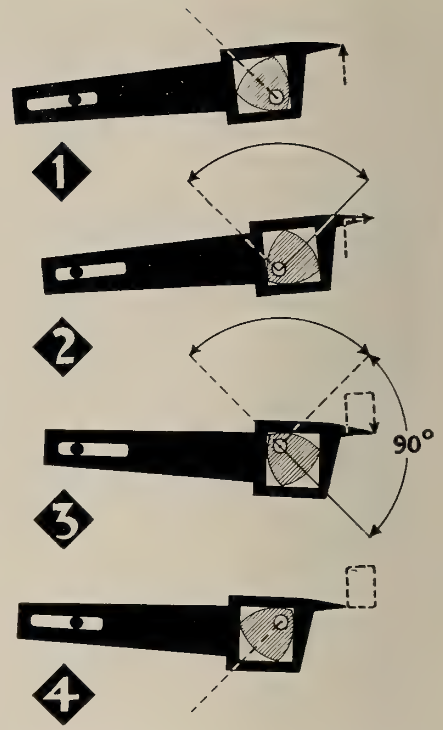


FIG. 2. Motions of a simple 3-to-1 claw intermittent. Note that the film-pulldown stroke occupies 90 degrees of the complete 360-degree cycle.

Several widely used makes of 35-mm studio cameras employ the shuttle-claw movement for maximum registration accuracy. Both 35-mm and 16-mm optical printers and color-process machines use similar claw intermittents. Registration pins that oscillate in and out of the film perforations in simple horizontal strokes are frequently added to insure perfect rock-steadiness of the images.

Claw Not For Heavy Duty

Desirable as it is for use in motion-picture cameras and printers, the claw intermittent unfortunately has several drawbacks which militate against its use in "heavy duty" projectors. Without the addition of oscillating registration pins, "overshooting" of the film due to inadequate gate tension is likely to cause the claw teeth to strike *between* the sprocket holes and puncture the film. And when the intermittent pulldown is lost, film may also suffer damage through tearing, through the prolonged exposure of frames to the hot projection light, or through attempts to restore the lower loop to proper size by pulling it down with the finger while the machine is running. (A

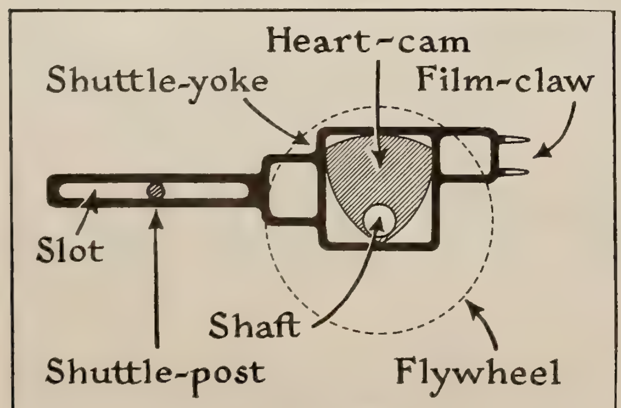


FIG. 1. Working parts of a simple shuttle-claw intermittent movement.

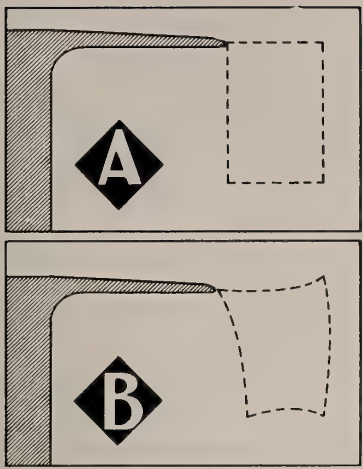


FIG. 3. (A) Claw motions when the distance between the heart-cam and the shuttle post is relatively long. (B) Claw motions with a relatively short cam-to-post distance. Note the "lifting action" of the claw in this case.

few 16-mm projectors have "loop-setters" for this purpose.)

Missed pulldown strokes in the early 35-mm claw-movement projectors usually resulted in out-of-frame pictures on the screen. To avoid this nuisance, the Lumière brothers perforated their 35-mm films with only one sprocket hole per frame along each edge.

The pioneer movie producer, D. W. Griffith, used similarly perforated negative stock in his claw-movement camera, but printed his negatives on positive stock perforated according to Edison's specifications, i.e., four holes per frame along each edge. It may be mentioned, in passing, that claw-movement cameras have "film jams" more frequently than sprocket-movement cameras.

Regardless of the width of the film, the use of claw intermittents in projectors complicates the design of framing devices to shift the picture up or down on the screen when misframes occur. Let us examine this problem more closely as it pertains to 16-mm projectors.

Now, 16-mm film has only one sprocket hole per frame but this does not mean that 16-mm projectors can do without framers! To the contrary, different 16-mm cameras place the framelines higher or lower with respect to the perforations (regardless of the desirability of a universal standardized frame placement.) It therefore occasionally becomes necessary for the operator of a 16-mm projector to rack the picture up or down *a short distance* in order to remove the frameline from the top or bottom of the projected picture.

Framing of a sort is accomplished in the less expensive 16-mm projectors by sliding the aperture plate up or down. This expedient unfortunately moves the whole rectangular field of light up or down on the screen while the picture remains stationary!

A better method involves a vertical movement of the entire optical train—lamphouse, condenser, aperture, and lens—thus reducing vertical movement of the projected field of light on the screen, *no matter how large the picture may be,* to a tiny, unnoticed fraction of an inch. With this method the picture, not the field, appears to move up or down on the screen.

The more expensive 16-mm projectors, such as those used in TV studios, resort to "theatrical framing," moving either the intermittent alone (sprocket or claw device) or the entire mechanism with all its gearing up or down when the framer is adjusted. In these cases the aperture and optical elements remain fixed in one location. Theatre-type framing poses a difficult engineering problem when the claw intermittent is employed; and, in any case, provision must be made to compensate for shutter mistiming which would result from altered relationships between the gearing of shutter and intermittent.

Writer's Framing Preference

The writer favorably regards the "up-and-down optics" type of framing as perhaps the most suitable for 16-mm shuttle-claw projectors in the lower-price range. The extremely small shift of the projected field which occurs during framing cannot be seen, or scarcely even measured, when the picture exceeds two or three feet in width. (A 0.001-inch shift of the aperture relative to the film shifts the field of light on the screen only 0.001 of an inch *regardless of the size of the picture.* Maximum full-frame racking is included in a 0.3-inch shift range!)

A more serious disadvantage of the claw movement is that it handles damaged films rather poorly, often missing pulldown strokes of the film or allowing the film to stop in the gate, burning out a frame and breaking the lower loop. Slightly chipped or worn perforations result in excessively jumpy pictures from projectors having only one claw tooth on the shuttle, and use of a single tooth aggravates the film damage.

When a total of more than three or four pulldown strokes are missed, shortening of the lower loop destroys the illusion of naturalness by displacing sound synchronism. It is most disconcerting to hear spoken words a moment before a person's lips begin to move! For perfect sound synchronism there should be 26 frames of 16-mm film (7.8 inches) between the gate aperture and the scanning point at the sound drum.

The Matter of Film Damage

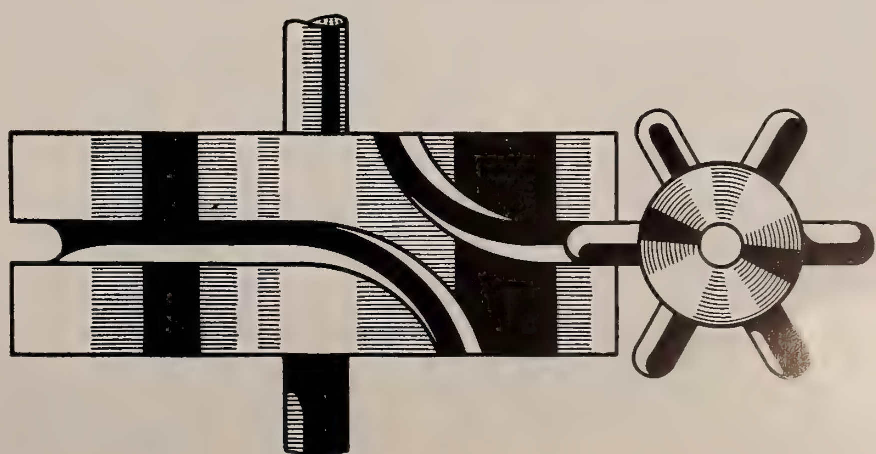
It is noteworthy that JAN (Joint Army-Navy) specifications require the intermittent mechanisms of 16-mm projectors to "feed film having two adjacent damaged or broken perforations without causing further damage to the film." Sprocket movements for 16-mm machines having 8-, 10- or 12-tooth intermittent sprockets readily meet this requirement; but claw movements need at least three *consecutive* teeth on the shuttle to accommodate film having two *adjacent* torn perforations.

Also according to JAN specifications, 16-mm film must show no marked deterioration even after 1,000 passages through the projector. Certain single-claw projectors are known to damage film perforations after only 100 passages!

Relatively rapid film wear is one of the more important disadvantages of the claw movement in projectors. Of course, 16-mm films are not subjected to the severe demands made upon 35-mm theatre-release prints; and this particular disadvantage of the claw intermittent is of no consequence in cameras. Fresh raw stock is run through a camera but once: 16-mm projection positives, on the other hand, are often required to endure hun-

(*Continued on page* 24)

FIG. 4. A simple drunk-cam sprocket intermittent.



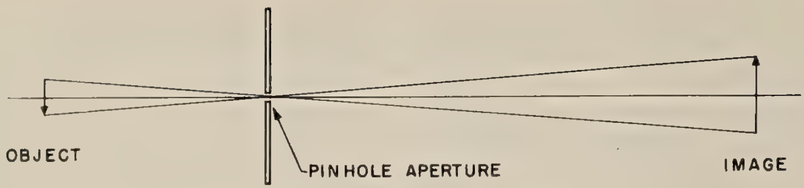


FIGURE 1A. Pinhole optical system.

Viewing the Projector as an Integral Optical-Mechanical System

By HAROLD E. ROSENBERGER

Bausch & Lomb Optical Company, Rochester, N. Y.

Using one component of the projector, this second installment pursues the argument that specifications for individual components cannot be arbitrarily assigned without regard to the other units of the system. This paper in its entirety was originally presented before the Society of Motion Picture and Television Engineers.†

WHAT does a projection lens do in the projection system? How does it form the image we see on the screen? What are its limitations? We do not really need a lens at all to form an image on the screen, as can be demonstrated by the well-known pinhole optical system shown in Fig. 1A. The pinhole optical system does precisely what we ask the projection lens to do in that it *establishes a relationship between the film and screen such that light from each point in the object on the film is directed to one exclusive point on the screen.*

Unfortunately, the pinhole optical system too severely limits the amount of image illumination for it to be often of practical use. We could double the light on the screen by adding a second pinhole in juxtaposition to the first, but at the expense of image sharpness, since the image formed by the second pinhole would not be in exact register with the first as shown in Fig. 1B.

Increasing the diameter of the first pinhole is equivalent to adding many pinholes adjacent to the first. Each new pinhole will add a new image on the screen, thereby increasing screen illumination, but at the same time adding more discord to the image and making it unrecognizable.

Overcoming Aberrations

We can retain the added screen brightness and regain image sharpness by inserting a simple lens in back of the now enlarged opening, as shown in Fig. 1C. The very center of the lens acts just like the original single pinhole and defines the position on the screen where each point of the image should fall. In addition, light from any one point on the object which is incident on the lens above or below its center will be bent toward the light going through the center for that particular point on the object, and will intersect with this light in the plane of the screen. This, of course, adds to image brightness while retaining image sharpness.

But if, again, we start enlarging the aperture, once again we begin to notice a softening of the image as its brightness is increased, due to the fact that the marginal regions of the lens do not converge the light rays to the same point on the lens axis as the central region of the lens, as shown in Fig. 1D. This effect is known as "spherical aberration".

In addition, a new cause for image softness in the form of colored fringes in the image will be noticed. This effect is called "chromatic aberration". Now, there is nothing profound about these aberrations. They are simply characteristics of a simple lens in the same way that hardness, or weight, or light transmission is characteristic of the lens.

Doublet Not the Answer

It was discovered many years ago that by combining two lenses, one positive and one negative and made from dissimilar glasses, as illustrated in Fig. 1E, both the spherical and chromatic aberrations could be greatly reduced. The immediate result of this discovery was that once again the lens aperture could be opened up to give added image brightness without a sacrifice of image sharpness.

While the importance of this discovery can hardly be overestimated, it nevertheless was not an ultimate answer to increased lens speed, for the doublet, as it is called, also has a characteristic limitation of lens speed.

Petzval Four-Element Design

Many investigators continued the search for improved designs. One of these designs which is still in use today is the well-known Petzval design in which four individual lens elements are combined to make up a single projection lens, as shown in Fig. 1F.

FIGURE 1D. Spherical abberation of a simple-lens optical system.

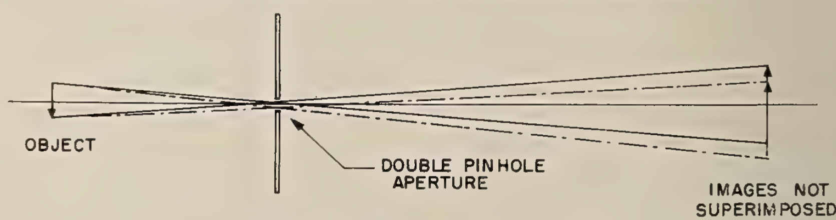


FIGURE 1B. Double-pinhole optical system.

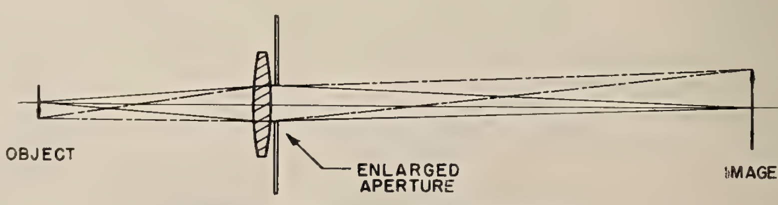
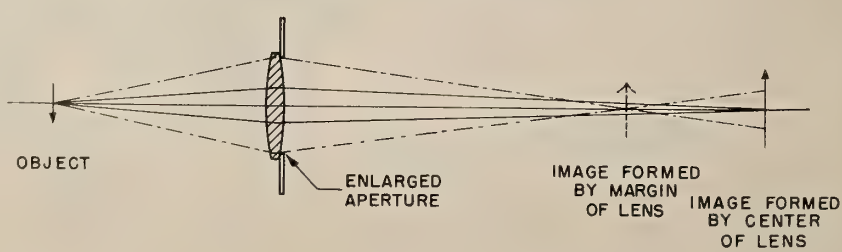


FIGURE 1C. Simple-lens optical system.



†Journal of SMPTE, April, 1958.

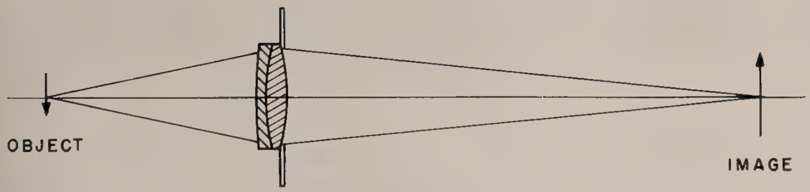


FIGURE 1E. Corrected optical system.

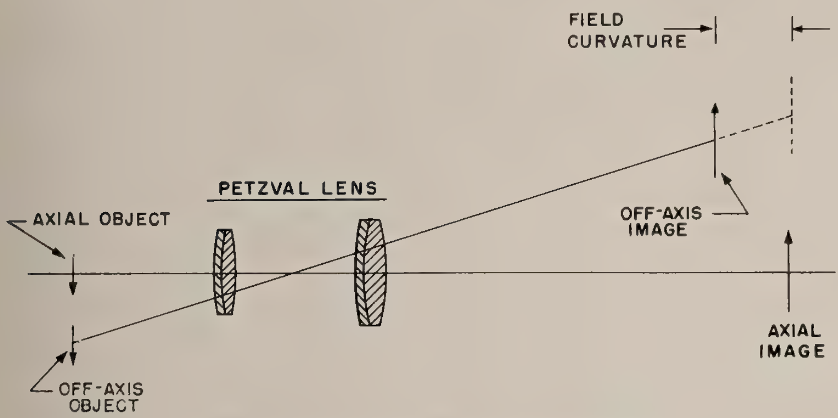


FIGURE 1F. Off-axis aberration in an optical system.

Up to this point we have discussed only central image formation. What about the marginal regions of the image? A glance at Fig. 1F points up the serious difference in the relationship between the lens and its axial object and the lens and its off-axis object.

Marginal-Region Image

In the first place, it is apparent that the off-axis object is located at a greater distance from the center of the lens than is the axial object. The effect of this is to cause the image of the off-axis object to fall closer to the lens than the axial image. This effect we call "field curvature".

Equally in evidence is the fact that the lens surfaces are not aligned symmetrically with respect to the off-axis object. This condition introduces additional aberrations, the names of which are unimportant, but the effect of which is a furtheir degradation of off-axis image quality.

Types of Projection Lenses

Through the years, as the result of the work of a great many designers, a type of projection lens has evolved which, within limitations of field coverage and speed, reduces the many aberrations to a tolerable amount for motion-picture projection.

This lens is called the Double-Gauss type and is shown in Fig. 1G. Depending on focal length, it is made up of six or seven separate lens elements. The Double-Gauss type is used by more manufacturers of high-quality projection lenses than any other type. For any given projection condition, it appears to represent the best that the present state of the art can produce.

To be sure, the history of lens development indicates that the future will bring further improvement just as we have all recently witnessed in the introduction of CinemaScope.

CinemaScope projection is attained by the simple addition of the anamorphic attachment to the standard projection lens. That this can be accomplished with so little effort is indeed a remarkable technical achievement.

Anamorphic Attachment

When an anamorphic attachment is combined with a projection lens, there results an entirely new kind of lens having properties quite different from either of its components. As we know, the magnification on the screen in the horizontal direction is different from that in the vertical. It follows, therefore, that the focal length of the combination of anamorphic *plus* projection lens in the horizontal is different from that in the vertical.

Now, it is possible to construct a lens having different focal lengths in the two directions by the simple addition of a cylindrical lens element in front of the projection lens as shown in Fig. 2A. But as shown in this figure, when we look at the combination from the side, the cylindrical component looks and act optically like a slab of window glass, while from the top it looks and acts like an ordinary spherical lens.

The result of this is that the combination has not only two focal lengths, but also two separated focal planes. Vertical structure on the film will be imaged *in focus* and horizontal structure *out of focus* at one focal plane, and the reverse at the other focal plane, but no focal plane will be found where *all* of the information on the film appears *simultaneously* in focus.

This intolerable condition is eliminated by the addition of a negative cylindrical lens element which, when made to the required focal length and properly positioned with respect to the positive element, pushes the near focal plane back to coincide with the far focal plane as shown in Fig. 2B. The addition of this

FIGURE 2A. Projection lens with cylinder attachment.

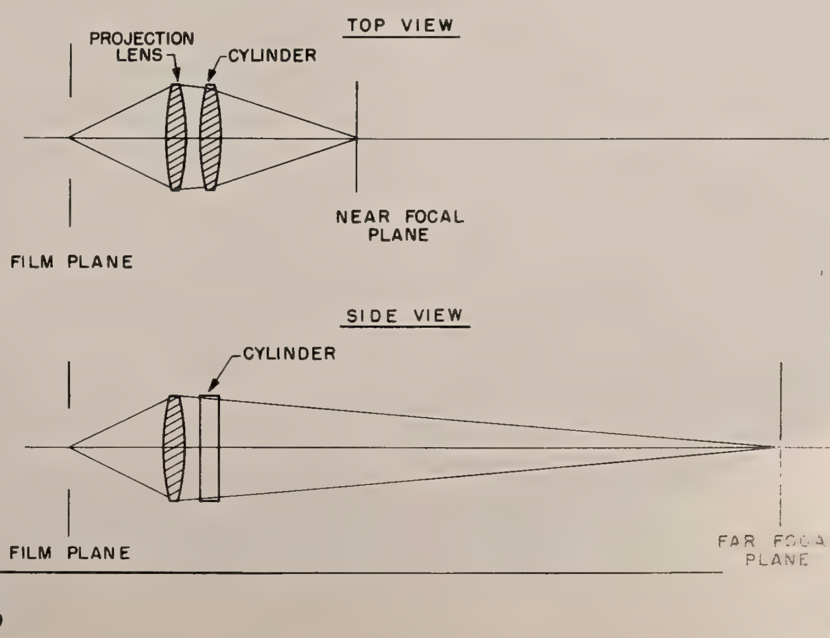
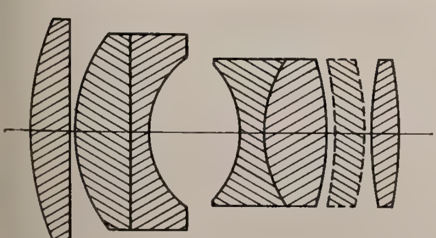


FIGURE 1G. Double-Gauss projection lens.



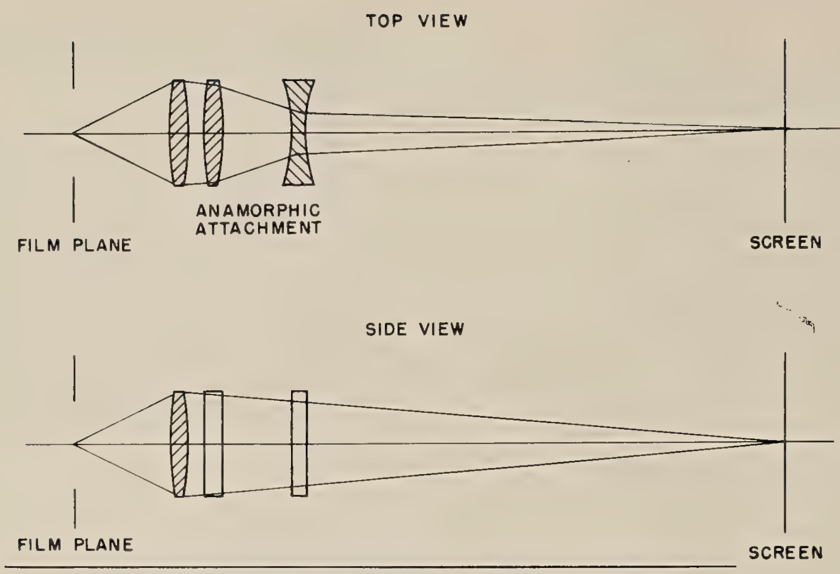


FIGURE 2B. Projection lens with anamorphic attachment.

negative element solves the focus problem; but does this combination give us a magnification in the top view different from that in the side view?

Factor of Lens Speed

The proof that the difference in magnification has been attained can be found in our Fig. 2B. Before looking for the proof, we had best review the meaning of that elusive optical quantity called Lens Speed or Lens f/number.

Customarily, projection lenses are rated for f/number, with respect to their object or film side, the f/number being numerically equal to the ratio of the film to lens or object distance divided by the free aperture of the lens. Now, the lens has an f/number rating for its image side just as well as for its object side, and this f/number numerically equals the lens-to-screen or lens-to-image distance divided by the same free aperture. Thus:

$$f/\text{Number (Image Side)} = \frac{\text{Image Distance}}{\text{Free Aperture}}$$

and

$$f/\text{Number (Object Side)} = \frac{\text{Object Distance}}{\text{Free Aperture}}$$

The relationship between the two f/numbers is therefore:

$$\frac{f/\text{Number (Image Side)}}{f/\text{Number (Object Side)}} = \frac{\text{Image Distance}}{\text{Object Distance}}$$

But since the ratio of image distance to object distance is equal to the magnification at which the lens is being used, f/number (Image Side) = f/number (Object Side) $\times$ Magnification.

It is a common experience for us that, for a given projection throw, we can increase image magnification on the screen by a reduction in focal length but that even though the rated speed of the shorter-focal-length lens is the same as that of the longer, the screen brightness decreases.

This observation is borne out by the last formula given which shows that the f/number on the image side increases, and therefore the lens speed decreases, with increased magnification. Thus, we have the rule that for a given speed on the object side the speed on the image side decreases with increased magnification, and *vice versa.*

Returning now to Fig. 2B, we note that the presence of the positive cylindrical lens in the top view causes the fan of rays to converge very rapidly toward the negative lens, and that after passing through the negative lens the fan is considerably reduced in speed compared to the fan in the side view. Since the speed of the *combination* of anamorphic plus spherical is precisely the same in the horizontal and vertical direction on the object side, we see that an increase in magnification has been attained in the top view, or *horizontal* direction.

[TO BE CONTINUED]

Westrex Bi-Lingual Reproducer

Westrex Corp. (Italy) has installed a unique bi-lingual (Italian & English) sound reproduction system at the new Metro drive-in in Rome. The Italian sound version is supplied by the standard photographic track of the release print. English dialogue is provided via a magnetic re-recorded sound track on a separate 35-mm magnetic tape run through a synchronized reproducer during the screening.

Simultaneous reproduction of the two sound tracks is accomplished by mechanically interlocking each Westrex R6A soundhead with an R8B magnetic reproducer. Both magnetic reproducer and projector are driven by synchronous motors. Drive-in patrons can select either Italian or English sound versions by flipping a switch on the junction box holding the Westrex in-car speakers.

The Metro's 125′ x 68′ reinforced screen is reputed to be the largest in Europe.

Okay Pay-TV Tests, BUT

The Federal Communications Commission has finally announced its readiness to accept applications for a test of pay-as-you-see television—BUT only on the following conditions:

1. Each of the five systems can be tested in only one city, and there are only 20 markets in the entire U.S. with four or more TV stations qualified for tests.

2. Each of the five systems must pay all the costs of installing the system in individual homes, a cost considered prohibitive. The decision specifically prohibits the systems from passing installation costs on to users.

Okay Regarded as "Joker"

3. Regardless of whether the tests prove successful or not, the tests will not in themselves grant permanency to any system.

4. The final judgment on whether pay TV is legal is up to Congress.

PERSONAL NOTES

Roger P. Loveland of Kodak Research Laboratories has been elected a life member of the New York Microscopical Society in recognition of his contributions to microscope science. He is research associate in charge of the photomicrography section of the applied photography division of the laboratories. Associated with Kodak since 1922, Loveland has become nationally known for his research in various aspects of photomicrographic science.

* * *

Frank E. Cahill, Jr., coordinator of technical activities on the east coast for Warner Bros. Pictures, Inc., has resigned to enter his own business as a motion picture and television technical consultant for studios, laboratories and theatres. Cahill, whose business headquarters will be established in Wyckoff, New Jersey, has been associated with Warner Bros. for 33 years.

* * *

Barbara D. Skeeter, a former newspaper editor, has replaced Wallace Shapiro as Director of Public Relations for the Society of Motion Picture and Television Engineers.

The Geneva Intermittent Movement:

By A. C. SCHROEDER
Member, IA Local 150

Its Construction and Action

The fifth and concluding article of a series which has detailed the what, the why, and the how of the "heart" of the motion picture projector. This definitive series has attracted world-wide interest.

PROJECTORS are more complicated than they would be if no framing device were needed. Probably the simplest device was used on the old Edison machines, where the entire mechanism moved up or down, and only the aperture plate and lens remained stationary. This was simple because the inside shutter moved with the mechanism, and the fact that this put the shutter out-of-time bothered no one. An outside shutter was added later, which also moved with the mechanism but remained "in time" because the shaft was directly below the lens and did not change the relative time that the shutter entered and left the light beam as the picture was framed.

The Powers projector had a fairly simple, although not entirely satisfactory, method of framing. Who remembers the old toggle gear and the troubles it occasioned? When the picture was framed it changed the gear-center distance, producing a difficult condition. It was no easy task to keep these gears quiet, and when the gears, toggle lever, etc., wore, they produced backlash in the shutter, with intermittent streaks flaring across the screen when the machine was cranked unevenly.

The Simplex Approach

Simplex attacked the problem in a different manner by revolving the entire movement. The problem was *where* to locate the axis of the revolving movement. The first thought would be the camshaft, because the camshaft gear must turn in a fixed position, and the bearings must remain in one position so that the center-to-center distance of this gear and the mating gear remains constant. However, the intermittent shaft would then swing in a circle around the camshaft, also carrying the intermittent sprocket around in a circle and causing complications at the front plate where the film was pulled down.

Revolving the movement about the intermittent shaft as a center kept the sprocket in the same position relative to the front plate and the aperture, but this caused the camshaft to move in a circular path, carrying its gear with it. To drive this "movable" gear it was necessary to have another gear the center of which coincided with the intermittent shaft, thus allowing the driven gear to roll around the driving gear as the picture was framed, *without changing* the mesh of the gears in the least.

Suppose that we hold the flywheel while the framer is moved. Then the intermittent case revolves and carries the camshaft and its gear in a circular path, *causing the camshaft gear to roll around the central gear*. The central gear cannot turn because it is on the flywheel shaft, which we are holding. Thus, by framing the picture, the driven gear and the cam have been turned through a partial revolution. What we have done, in effect, is to hold the shutter stationary and turn the cam through a certain angle, thus throwing the shutter out-of-time.

This has been provided for, however. Around the intermittent case is a ring with a cam, and by means of a plunger and a lever, the cam slides a spiral gear along its shaft. This gear is in mesh with a somewhat similar gear. As we move the framer, while holding the flywheel, this spiral gear slides along its shaft and causes the "mating" gear to revolve, which in turn revolves the shutter, thus keeping it in time.

Film Transfer Needs Power

The movement requires considerable power during the film transfer; but very little power is needed at other times. Power is needed to pull down the film against the resistance of the tension shoes, and to start and accelerate the parts. The machine runs quite free while the film is stationary, and when the load is suddenly applied in order to move down the next frame, it imparts a severe jar to the gears, bearings, *etc.* To overcome this, a flywheel which has a comparatively large momentum is used to drive the cam while the film is moving.

This was quite apparent when the machines were cranked. When cranking very slowly we felt a greater resistance as each frame was pulled down. On speeding up a trifle the uneven resistance was less noticeable; and as the speed increased further the uneven resistance disappeared completely: enough energy had been stored in the flywheel so it could drive the movement while one frame was pulled down, without additional power from the crank.

The location of the flywheel is important. If it is placed on the shutter shaft, for instance, all the gears, pins, and other parts between the shutter and the cam are subjected to uneven torque. This causes undue wear on these parts and occasions considerable noise. The flywheel should be right on the camshaft; but this is inconvenient on the Simplex, so it is placed on the shaft which drives the camshaft. The uneven torque is thus transmitted through only two more gears.

Adjustment of End-Play

The working parts in the Simplex movement comprise the flywheel shaft which, in the intermittent case, parallels the intermittent shaft; the two gears mesh, and the cam contacts the star. The longitudinal groove in the flywheel shaft is for oil distribution. The shaft runs in a long bearing, and portions of it may starve unless oil is distributed throughout the entire bearing.

End-play is adjusted at the flywheel. After loosening the lock screw, the knurled knob is held and the shaft is turned with a screwdriver until a *just perceptible* endwise movement of the shaft is present. With *no* end-play, there is danger of the shaft tightening up. Too much end-play results in clatter. Be sure to retighten the lock screw.

Projectionists not infrequently notice travel-ghost after making this adjustment, but fail to connect the two. When

(*Continued on page* 22)

An Exercise in Semantics

A performer is a performer! Dr. Charles S. Cameron, formerly Medical and Scientific Director of the American Cancer Society and now Dean of Hahnemann Medical College, Philadelphia, had to join the American Federation of TV and Radio Artists before appearing as the medical expert on the Society's series of "Tactic" TV programs on cancer control, produced by NBC.

Question: Does NBC now have to join the American Medical Association?—THE FILM DAILY

In the SPOTLIGHT

Lorraine Theatre Equipment Test Plan

OF RECENT years the servicing of projection room equipment has been on a hit-or-miss basis, and in all too many situations the only servicing work done is by the projectionists. However competent the latter may be they do not have the equipment to do the job properly—often even not a light meter—and no theatre that drops its service contract will spend any money for servicing units.

This inattention to even the bare servicing requisites, often for long stretches of time, is responsible for the poor state of equipment and deterioration of screen image, as revealed by the recent Research Council survey.

The Lorraine Carbon Program

To fill this servicing vacuum at least one enterprising manufacturer has taken positive action, and at no cost to the theatre. Carbons, Inc., distributors of Lorraine carbons, has for some time now been rendering a checkup service to any theatre that requests it. The demand for this service has been rising steadily, requiring an expanded inspection staff—John Twiehaus of IA Local 143, St. Louis, is the latest addition to the staff.

An inflexible rule of the Lorraine plan is that even though requested by a theatre to survey its equipment, no fieldman will enter a projection room without the approval of the projectionists on duty.

The first step is to check the a-c input line to the generator or rectifiers. Many theatres are paying for, say, 220 volts but are being fed considerably less power. This is a special problem for drive-ins which often are at the end of the transmission line and are affected by other new industries, motels and such.

Then, too, in many theatres the generator or rectifier may be overloaded or be so old that they have become "weary." Alerting the projectionist to the fact that certain rectifier stacks are running too warm, or that the drop in light level at changeover is a generator fault, enables him to anticipate and correct problems before trouble occurs.

In addition to a Karl Freund Spectra meter and a Luckeish-Taylor meter, each Lorraine man is equipped with a Panavision brightness meter developed by the Research Council which enables the standardizing of screen brightness readings. Each of the meters has a special adapter for reading drive-in screens; instead of using the 1-to-30 foot-lambert scale the meter is converted to the 1-to-6 foot-lambert range, much closer to drive-in reality. Readings of incident light on the screen in foot-candles are also taken.

Lorraine engineers carry the alignment tools recommended by lamp manufacturers, in addition to special tools built for quick and easy access to the lamps.

Many requests are received for changing the generator ballast or the rectifier taps in order to equalize the power supply to both lamps. Also noted is the light washed out on the screen by ambient light sources. Also checked are the porthole glass and lamp heat filters. Special equipment enables the taking of voltage and amperage readings without interference with the show.

Lamphouses are particularly susceptible to vibration: even the opening and closing of lamphouse doors might occasion misalignment. On certain lamps the motor feed ratio is of great importance. Not infrequently a change of carbon sizes is made which affects the feed ratio. A change in feed ratio or in carbon sizes will usually correct this condition.

Color Film Available

Supplementing the aforementioned service is a 28-minute film which shows the manufacture and use of arc carbons. The first part in black-and-white covers the manufacturing process; the second section, by means of a cartoon and live action in color, shows the carbon arc operating. Mirror alignment is also visualized.

First showing of this film was given before IA Local 511 in Jacksonville, Florida. This 16-mm film is available for showing to small industry groups. Direct the request for same to Carbons, Inc., P. O. Box 217, Boonton, New Jersey.

Simplex E-7 Operational Tips

DON'T fill the intermittent movement of the E-7 while the mechanism is in operation. The movement should be filled with Simplex Oil to the indicated level on the sight glasses *only* while the mechanism is at rest.

Provision is made in this movement to eject any surplus lubricant over and above the predetermined amount. When the projector is in operation the oil in the oilwell is splashed and pumped all around the internal structure of the movement, thus any lubricant added at this time will only raise the oil level and be ejected when the mechanism comes to rest, unnecessarily messing up the equipment and causing the projectionist to believe he has an improperly oil-sealed movement.

Owing to the increased length and larger number of tension shoes on the gate of the E-7 mechanism, a patch passing through the mechanism will make itself heard with slightly more emphasis than on previous models. This should not cause alarm, however, since no damage is done to either the film or equipment.

Projectionists will find that it requires only a short time to become accustomed to the slightly different sound in the operation of the E-7 mechanism, however difficult it may seem at first inspection.

• The collective bargaining contract covering 15,000 film industry workers in 21 Local Unions has been formally ratified by representatives of the IA and major film producers, TV film producers and film processing companies.

Terms of the agreement provide for a 21-cent an hour increase in wages and fringe benefits. Also included are an increase in payments into the industry pension plan and extension of health and welfare benefits. Health insurance was granted for retired employes and life insurance coverage for employes was increased from $1,000 to $2,500.

The contract runs for two years. The negotiations marked the first time major film producers, TV film producers and film processors have joined together to set terms of a contract.

• The New York State Association of M. P. Projectionists, which has done yeoman work in the fraternal and sociological areas during many years past, will hold its annual Spring Meeting in Hornell, New York, on May 18 next. Host IA Local will be No. 676.

Planned is an extensive section on video tape recording and reproduction.

How to Use a Microphone

AT FIRST THOUGHT it may seem superfluous to offer advice on using microphones. If their use amounted to no more than connecting them to amplifiers and speaking into them, however, the sound recorded on tape, disc, and film would be uniformly good. All of us are well aware that many recordings could often be much better than they are.

A microphone is an "electronic ear" which "hears" sound somewhat differently than the human ear does. Carelessly employed, the microphone may hear *too little* of the desired sounds—speech or music, for instance—and *too much* of the unwanted incidental noise we do not wish to record or transmit.

Some Common Shortcomings

Examples may be given. When a teacher records his voice on the magnetic stripe of an otherwise silent teaching film, he has no desire to include the whir of the projector in his discourse. When students make tape recordings during oral examinations, or in public-speaking, dramatics, and music classes, excessive "room noise" mars the recorded sound and renders it less useful as an educational aid.

A more spectacular example of faulty use of the microphone occurs when the loudspeakers of a PA (public-address) system "feed back" the sound to the microphone. Loud ringing and howling noises are generated.

Other common misuses of the microphone are "blasting" (speaking into the microphone too loudly) and insufficient volume of voice. Breathing upon or jarring the microphone likewise spoil the sound record. Most of us have noticed, in TV broadcasts, the rattling noises generated when a microphone suspended from a speaker's neck in the manner of a lavaliere strikes against buttons or jewelry.

These examples do not include such electrical errors as microphone impedance mismatch, overload, line attenuation and noise pickup, etc., a subject which would take us far afield. Let us therefore assume that the microphone we are using is the proper type for the available amplifier, that it is correctly connected, and that the amplifier input level (volume control) is adjusted to avoid too weak a record on the one hand, or overload and distortion on the other. We may then direct our attention to the *acoustics* of using a microphone.

Types of Microphones

There are four basic types of microphones in addition to the carbon unit ("button mike") now employed only for telephone service, and the condenser microphone, which is little used at present.

The dynamic microphone is a widely used type because of its high output, ruggedness, and dependability. It is practically non-directional, picking up sound from behind and from both sides almost as well as from the front. Although very satisfactory, the dynamic microphone is inferior to the "velocity" types for high-fidelity work.

The crystal microphone is less rugged than the dynamic, and it is ruined by moisture and by temperatures in excess of 125° F. The fidelity of its response is fair and its angle of sound pickup is as wide as that of the dynamic mike. The crystal mike is often supplied with low-priced tape recorders.

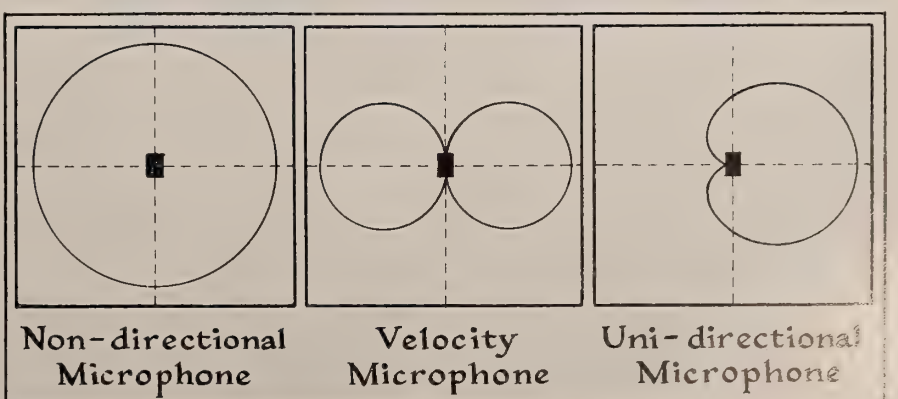
Dynamic and crystal microphones are not interchangeable, however, as their electrical impedances and frequency-response characteristics are very different. An amplifier designed for the exclusive use of a crystal microphone requires a "matching transformer" to accommodate a dynamic or variable-reluctance microphone.

The Velocity ("Ribbon") Mike

The velocity microphone ("ribbon mike") has a very light metallic ribbon suspended between the poles of a strong permanent magnet. Unlike other microphones, the velocity mike, widely used in high-fidelity recording and broadcast work, is actuated by the movement of air molecules instead of the pressure waves generated by sound. Its response is remarkably faithful to the original sound, but its output is so feeble that it can be used only with high-powered amplifiers. To be used with an ordinary dynamic- or crystal-mike amplifier, the velocity microphone requires a special "pre-amplifier" to increase its weak output to a sufficiently high level for further amplification.

Most microphones of this type

Directional sound-pickup characteristics of different types of microphone.



have a built-in matching transformer to permit the use of long microphone cords and a moderately high input impedance.

The most interesting thing about the velocity microphone is the pattern of its sound pickup. It responds to sound only from in front and from behind it, being quite "deaf" to sound waves impinging upon its two sides. With this microphone it is possible to sit fairly close to an operating motion-picture projector when recording commentary on a magnetic sound-track without picking up much machine noise. It is only necessary to make certain that a side of the microphone faces the projector.

The uni-directional microphone is a modified velocity mike which picks up sound only from in front. It also requires an extra stage of electrical amplification; but many of the better high-fidelity tape recorders are furnished with velocity and uni-directional mikes, and so have matched amplifiers of requisite power. It goes without saying that the higher tape speeds should be used to capture all the tonal brilliance of music.

Use of the Microphone

The microphone may be held in the hand when only one person is recording his voice. A little preliminary practice will insure his maintaining a 12-inch distance between the microphone and his lips. For group recording, the microphone should be supported by a mike stand or sound boom. A group of speakers seated at a small table may *talk over* a microphone placed on the middle of the table. It is advisable to cover the table with a heavy towel or rug to deaden sound reflections.

The avoidance of "acoustic feedback" is extremely important in sound-reinforcement and other public-address work. Feedback of sound to the microphone from the loudspeakers causes annoying howling, whistling, and ringing noises. When a velocity-type microphone is employed, place the loudspeakers in a line with the *sides* of the mike. If a non-directional dynamic or crystal mike is used, it may be necessary to reduce the volume of the loudspeakers considerably.

For the recording of speech or music in rooms of rectangular shape, place the microphone so that it faces a *corner* of the room. This arrangement will minimize the "boomy" effect of direct sound reflections from flat walls.

Draping to "Dampen" Sound

It is often very helpful to hang heavy draperies on a screen-like support a few feet behind the person who is recording. When a non-directional microphone is used, an additional improvement in the sound will be obtained by also hanging drapes behind the microphone.

Small rooms containing draperies, heavy carpets, and upholstered furniture are acoustically "dead." These are the best locations for voice recording. Large bare-walled "live" enclosures are best for instrumental music and choral singing because the presence of reverberation lends depth and richness to the sound. Avoid the exaggerated "empty-barrel" echo effect used in commercial popular-song recording, however.

Keep the microphone as far away from the recording machine as possible to avoid noise pickup. When recording speech on magnetically-striped motion-picture film, project the picture through a doorway into another room. The commentator should be seated in this room away from the projector to minimize machine-noise pickup on the sound-track. The mike should be held about eight inches from the lips and the voice kept a trifle lower than normal.

Always guard against breathing upon the microphone or striking it with pencils, papers, etc. If a prepared text is to be read, have it copied on soft Manila paper to minimize rattling noises when the pages are turned.

Lens Focal Lengths and Screen Sizes

More attention should be paid to image sizes used in the classroom. All too often the proper useful screen size is not selected, and by extension of this criticism, we find that incorrect lens focal lengths are used in A-V equipment.

Let us deal first with the best screen size in order that picture detail may be at its best. Bear in mind that we must keep the screen down to its proper size in order to obtain optimum illumination. The latter consideration is dictated by the conditions of rather high background level which prevail in most classrooms. On occasion this light level is necessary in order that eyestrain for the viewer may be reduced, but this requirement does not aid in the production of better and more effective presentation.

What *is* the correct screen dimension? This question may be answered by consideration of the distance from the screen to the farthest viewer. We recommend the use of the following simple rule in selecting screens:

Take the number of feet intervening between the screen and the most distant viewer, multiply by two, and the resultant figure will give the minimum screen size in inches. If

FIGURE 1. Reading horizontally, all lenses in a family group will render the same width picture for the designated picture aperture size. (FIG. 2 shows the image sizes at varying projection distances for each "family".)

'FAMILY' Number	16 mm.	35 FS	2 x 2	3 1/4 x 4
1	1 1/2"	3 1/2"	5 1/2"	12"
2	2"	5"	7"	16"
3	2 1/2"	6"	9"	20"
4	3"	7"	11"	24"

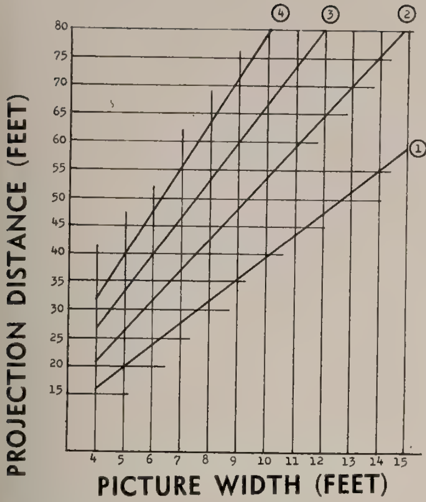


FIGURE 2. Linear representation of picture sizes obtained by use of "family" group lenses.

this figure is used to purchase screens, far better results should be obtained.

"Family Relation" of Lenses

In referring to the use of incorrect lens focal lengths, we had in mind the fact that much equipment is in use without regard for compatibility of image sizes. How many purchasers or users of A-V equipment realize that there is a "family relation" between lenses used in various devices?

In Fig. 1 is shown the correct focal lengths of lenses to be used in 16-mm projectors, 35-mm filmstrip devices, 2″ x 2″ slide projectors as well as the less frequently encountered 3¼″ x 4″ size.

Dual Use for Slides

Figure 2 graphs the image sizes in screen widths which may be obtained by the various family groups of lenses. The only factor to be observed in the purchase of screens is that a screen providing the same vertical dimension as the indicated width should be available for the square pictures obtained in some of the slide projectors.—JOSEPH F. HOLT.

IA OBITUARIES

STUART, BERT, member of Toronto Local 173 for the past 40 years, died on March 17 last. He was buried in his town, Brampton, Ont.

• • •

HALL, W. M., 56, member of Local 335, Bradford, Penna. since 1926, died of a heart attack on January 31 last. Active in Local Union affairs, he served the Local as secretary-treasurer from 1948 to the time of his death. He represented his Local as delegate to IA Conventions, including the 1958 convention in St. Louis.

Using Closed-Circuit TV in Education

By FRANCIS E. ALMSTEAD

Special Consultant on Educational Television

New York State Education Department

II. Classroom Equipment and its Utilization

This concluding article of two (the first having detailed the objectives of the program and the requisite transmission technique) summarizes the equipment used in the classroom and the technique for its full utilization. Nerve center of the operation is a studio in Cortland County, New York.

THE coaxial cable route in Cortland is about nine miles, the extension to Virgil is six miles and the extension to Truxton is about eleven miles. Situations representing various distances were chosen so that a cost analysis based on mileage and pupils served could be made. It seems logical to believe that a long cable to serve few pupils may not be practical. We hope to determine from experience with this installation the number of pupils required per mile of cable for an economically feasible operation.

Classrooms are equipped with two 24-inch or 21-inch table model TV receivers and the system of distribution in each school is designed to supply a minimum of 1000 microvolts to each receiver. These are modified by adding speakers which are mounted in the front and below the receiver, and three 5-inch speakers serving the talkback system. These speakers are used also as microphones and are suspended from the ceiling.

Talkback System Vital Link

The talkback system is an important feature in the project. When used the pupil may talk to the teacher or the teacher may seek an answer from a pupil. Through the use of switches and signal lights the circuit can serve either the pupil or teacher.

Pupils when asking a question or giving an answer are not required to leave their seats. Pupils in all other classrooms associated with the studio, as well as the studio teacher, will hear the child's voice clearly and without distortion. This system gives pupils the feeling of belonging and security through participation.

It is essential for all equipment from cameras in studios through receivers in classrooms to operate at peak performance at all times. Without excellent picture and sound quality throughout the system, transmission of intelligence will be substandard. This cannot be tolerated. It is important, therefore, for the project to have a full-time, well-qualified electronics technician. He has responsibility for the maintenance of all studio equipment and all TV receivers at the schools.

Experience may demonstrate the need for two technicians, one to concentrate on studio equipment, the other to give his attention to receiver maintenance.

Quality Lessons Imperative

It is important that the televised lessons coming to the classrooms be of high quality, appropriate and timely to learning. It is of equal importance to create in the classrooms proper conditions and atmosphere. Too many pupils viewing at one receiver, too great a distance between viewers and set, improper picture contrast and brightness, poor sound and poor picture definition will be deterrents to effective learning.

Important Technical Considerations

Ideally, receivers, tipped slightly forward at the top, should be placed on stands in a room so that window glare does not interfere with the pupils' vision and so that the center of the picture is slightly above eye level of the viewing group. It is also important for pupils to have those materials and supplies necessary to enable them to participate fully in the televised lesson. It is the responsibility of each teacher to make certain that classroom and receiver conditions are proper for maximum learning.

A TV receiver when placed in a

classroom has a role different from that which it plays in the home. At home, viewing is casual and generally done for entertainment, while in the classroom it is the means of communicating intelligence to viewing pupils. Therefore, the circuitry of the receiver must reproduce the input message with a minimum of degradation. Design and performance of the set must be of high quality.

Important Technical Requisites

Experience has found the following technical considerations to be of great importance.

1. 90° picture tube, which gives better focus and less distortion than the 110° tube.
2. High voltage power supply with an output of 18 kilovolts; in no case less than 16 kilovolts.
3. Variation in voltage greater than 2 kilovolts between maximum and minimum brightness control adjustment.
4. Isolated chassis and a transformer power supply with heaters in parallel.
5. Adjustable keyed automatic gain control.
6. In the I. F. video section a band width of 4.5 megacycles and in the video amplifier a band width of 3.5 megacycles. These conditions make possible 300-line definition in the picture readable from a standard test pattern.
7. Brightness control range from black to 60 volts above cutoff.
8. Sensitivity range for lower channels at least 20 microvolts and for higher channels at least 40 microvolts to produce a 20-volt peak-to-peak input to the picture tube.
9. Audio amplifier with five watts of undistorted output.
10. Full range response speaker, 80 to 13,000 cycles, flat to ±3 db, baffled properly and mounted at the front.

System Expansion Contemplated

This system of communications has been designed with the idea of expansion in mind. While the coaxial cable now accommodates two channels, a total of six channels can be made available. Cable could be extended to several smaller towns and villages to serve more classes of elementary and secondary school pupils. Expansion within present schools is also possible.

Broadcast reception in the Southwest area of New York State is poor, so poor that many of the communities use community antenna systems. It is possible to feed all of these systems from the Cortland project. This distribution would cover ten cities and several smaller communities. In fact, this project has been designed to serve education in so many ways, expansion is almost limitless.

The Results to Date

While the period of these experiments in instructional TV has not been long enough to explore all the possibilities, certain tentative conclusions can be drawn.

1. Total teaching can be successful in all phases tried, from the third grade through college.
2. Two to eight viewing rooms are used effectively with one studio. Even for subjects requiring extensive student participation, a teacher can properly teach students in several rooms.
3. In total teaching via instructional TV, one teacher can serve from two to eight classes in small rooms and still retain two-way communication with the pupils.
4. The student using instructional TV must develop a new listening skill and accurate observation in order to learn. He must also learn a new technique in note-taking.
5. Results of examinations given to students using the TV technique and those taught under conventional methods show no significant differences between the two groups. In many cases those learning by TV received higher academic grades.
6. The medium of instructional TV demands that the teacher give his best performance.
7. Teaching by TV emphasizes the great need for careful preparation of the lesson, the use of carefully selected and well-prepared visual or audio materials, the need for cooperation among teachers in designing and preparing lessons and using teaching time effectively.

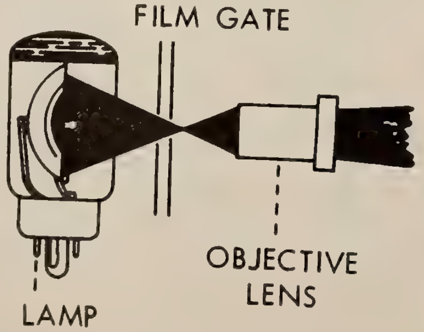
New Teaching Mechanics

8. For the teacher, the use of two-way audio communication allows retention of conventional classroom techniques but may require a change in mechanics: visualization of the class in the different classrooms behind the camera; new space relations required by the restricted area for movement in front of the camera; definition and pacing the speed of speech, and learning to teach without visual reaction from the students.
9. Student teachers can review, by means of TV recordings, unrehearsed happenings in classrooms and student teaching activities, offering the advantage of self-analysis. Student time and staff hours can be saved by permitting a large number of student teachers to view the same classroom activities and examples of superior teaching, avoiding travel to distant communities in small groups.

* * *

Sylvania's Millionth Tru-Focus

SYLVANIA ELECTRIC on February 25 produced its 1,000,000th Tru-Focus projection lamp—a tiny, high-precision light source that has revolutionized design and styling of color-slide and motion picture projectors since its introduction three years ago. It was the first projection lamp in 30 years to follow completely new manufacturing technique providing greater brilliance with less size, weight, heat. It also was the first capable of burning in any position, including horizontal or base down.



The Sylvania Tru-Flector optical system.

Kodak Cavalcade Projector

A NEW, FULLY AUTOMATIC, 500-watt Cavalcade Projector for budget-minded color slide users has been announced by Eastman Kodak. Designated the Automatic Cavalcade Projector, Model 520, it is of the same basic design and includes all of the important features of the Model 500 which has proved so popular since its introduction last year. Kodak refers to these projectors,

which change slides by themselves, as the "Deluxe 500" and the "Thrifty 520".

It will automatically show up to 40 cardboard or 30 glass-mounted slides at 4-, 8-, or 16-second intervals. A push of a button switches the projector to semi-automatic operation, allowing changing of slides at any interval desired. The screen darkens between slides so that they are not visible as they move in and out of position. During automatic operation, a manual control wheel permits the projectionist to repeat, skip or hold slides at will or to reverse the sequence. Slides stay in focus during the showing because each one is "treated" by a current of warm air to prevent sudden expansion.

Editing is Greatly Simplified

Editing is easy with this projector. Slides may be taken out or inserted without removing the trays which are placed in the projector right side up—no danger of spilling. Each slide is held in a rust-proof steel protector, accurately formed by precision dies to insure smooth changing without jamming. At no time does a slide touch the projector mechanism.

Finger-tip touch operates the smooth-working focusing and elevating knobs atop the projector. Elevation is from zero to nine degrees. A separate control permits leveling of pictures on the screen.

* * *

Filmstrip Pressure Glasses

MOST 35-MM FILMSTRIP projectors are fitted with glass pressure-plates at the aperture to hold the film flat and keep it from buckling during exposure to the light. Without such plates, the pictures would have to be refocused frequently even during the projection of a single frame.

Exercise Care in Cleaning

Because the glass plates are in close contact with the film, scratches and specks of dust on their surfaces show up clearly on the screen, mar the picture, and distract the attention of the students from the subject-matter of the filmstrips. It is necessary to remove the plates from the projector and clean them whenever the projected field of "blank light" gives evidence of dirt and smudges.

Wipe the glass plates with lens

tissue or lint-free cotton cloth, first breathing upon them to form a film of moisture. The presence of finger-marks or oil-mottle requires preliminary washing in mild soapy water. They should then be brushed with lens tissue after rinsing in pure water.

Scratched plates should be replaced with new ones at the earliest opportunity in order to avoid injuring the filmstrips. When replacing the glass plates into their holders, be sure that the ceramic film-margin runners on the two plates face each other. In a certain make of filmstrip projector, the plate marked "Back" should be installed in the adapter side marked "Back."

* * *

New Westinghouse Lamp

A NEW LAMP for slide and movie projectors which has its own reflector sealed right in the bulb is now being offered by Westinghouse.

Known as the proximity reflector lamp, the new bulb is said to produce 20% more screen brightness than ordinary lamps, the result of a spherical molybdenum reflector which is precision positioned immediately behind a concentrated tungsten filament.

The tiny ½ inch reflector greatly increases the efficiency of the projection lamp since it reflects more light through the projector's optical system. In addition, the spherical shield reflects heat away from the rear of the bulb wall thus reducing the normal blackening of that area. This results in cooler lamp operation and increased filament efficiency.

GENEVA INTERMITTENT

(*Continued from page* 15)

the adjustment is made, the knurled knob is held, which also holds the shutter stationary. The flywheel shaft is then turned with the screwdriver, thus turning the gears and the cam in the intermittent case. Note that the shutter is stationary while the cam is turned— which amounts to holding the cam and moving the shutter.

Immediately below the flywheel shaft is the camshaft. To adjust end-play loosen the lock screw, or screws (on some movements this requires removal of the flywheel). Then the flywheel (or the flywheel shaft, if the flywheel has been removed) is held while the nut on the camshaft is turned until the end-play is correct. Invariably, in all cases the end-play should be tested again *after* tightening the lock screw.

This holds true for many other adjustments about the mechanism. Locking the adjustment may throw it off, in which case it must be done again.

After adjusting end-play in either shaft, the movement must turn perfectly free, if it has seen considerable service. On a new movement the bearings will bind enough so that this cannot be taken as a criterion, and makes attainment of proper end-play more difficult. In either event, the test should be made with the star in the locked position, because the pin may fit snugly in the star, or the intermittent shaft bearings may add a little drag, which throws one off.

To adjust star-and-cam relation, the movement is turned so that the cam is directly under the star. The screws on the cover are then loosened and the weight of the cover and the parts carried by it forces the star down against the cam. Only a thin film of oil will then separate them. Tighten the screws again, and the job is done.

Next on the intermittent shaft the star is on the right end, and immediately to the left is a spiral groove, which also controls the oil; but this one keeps the oil from flowing to the right and out of the bearing, preventing loss of oil and a messy machine. The groove acts like a thread to "screw" the oil back into the case.

Sprocket-Change Procedure

In the center of the shaft are two holes for the taper pins which fasten the sprocket. Unless one has had considerable mechanical experience, it is best not to touch these pins nor to install a new sprocket. However, to help those who may have to change a sprocket, a few pointers are given here.

The taper pins are forced in under considerable pressure, requiring strenuous effort to remove them. Unless certain precautions are taken, this pressure is enough to "spring" the shaft or damage the sprocket. A device is available to remove and to replace these pins with little chance of trouble.

Lacking such a device, the shaft and sprocket are placed on some support so that the metal immediately surrounding the pin rests on it. If this be a block of hard wood, no hole is needed for the pin as it is driven through. However, if a metal support is used, a small hole must be drilled in it so the pin can fall out of the sprocket.

A hammer and punch are used to remove the pin, placing the punch on the *small* end of the pin. The punch must not be much smaller than the pin, otherwise it will bury itself and expand the

pin, wedging it in the hole tighter than ever.

After removal of the pins, the sprocket is slid off: the new sprocket should slide on easily. The holes in the sprocket are also tapered, and the large hole must be adjacent to the large end of the hole in the shaft. After the holes in the shaft and the sprocket are aligned, place the small end of the pin into the large end of the hole. Drive it in securely, but do not use extremely heavy hammer blows. The support must again be used under the central portion of the sprocket. Cut off the projecting portions of the pins flush with the sprocket.

The shallow groove at the left end of the intermittent shaft is for the set screws holding the collar. This collar determines the end play. After loosening the screws the sprocket and shaft are pulled firmly away from the machine, the collar is set up close against the bearing, and the set screws tightened. Do not pull too hard, as the sprocket is light and might bend. If the collar has been set up a trifle snug, loosen the set screws slightly, not enough so that they are completely free. Now tap the end of the shaft lightly until it just turns freely; then tighten the screws. Check the adjustment again after tightening the screws.

The holes in the ends of the sprocket are to lighten it as much as possible and yet retain the required strength and rigidity. Remember that the sprocket and the shaft are started and stopped 24 times a second, and that the heavier the parts, the harder it is to do this, throwing more strain on the rest of the machine and on these parts, too.

Inside the intermittent case is an oil deflector which scoops up oil that is thrown by the star wheel and directs it into the holes to lubricate the bearings. It is a sort of circulating system: oil is constantly draining into the bearings and they are kept practically flooded.

The Motiograph Movement

In the Motiograph movement, on the left is the cam and its shaft. On the left end is a flat spot against which the flywheel lock screw seats. There is another similar flat directly opposite, for the second lock screw. On the right end of the shaft is the cam ring and the pin. Immediately to the left of the cam ring is a heavy disc, which supports the cam ring and also acts somewhat as a flywheel.

Just to the left of this disc is the spiral oil groove. The first impression might be that this is two diagonal grooves or slots, but actually it winds around the shaft and is one continuous groove.

Above and to the right is the star and its shaft. This looks very similar to the Simplex star, but close inspection reveals that the back of the slot is closed by a web, which supports the points of the star just where support is needed most.

Here we have another oil groove, but this is sort of a double affair. A short groove, hardly discernible in the picture, tends to send oil from the star end of the bearing into the center. The other groove, which is about twice as long, returns the oil, keeping it from oozing out of the other end of the bearing. The two holes, of course, are for the taper pins.

The cam and star operate in a housing containing a semi-solid grease. In action the parts in the chamber churn the grease and, because of the design of the chamber, so keep the grease in motion that it is continually being forced over and around the parts it is to lubricate.

Careful Procedure Indicated

The flywheel, as indicated previously, is mounted directly on the cam shaft. To adjust end-play, two small screws in the face of the flywheel near the outer edge are first loosened. These screws lock the set screws which fasten the wheel to the shaft. The actual locking screws are two long screws, the heads of which are set in the periphery of the flywheel. After

loosening these, the flywheel is pushed inward while pulling out on the knurled retaining screw on the end of the cam shaft, thus removing whatever end-play exists. The two long screws are tightened first; then the two small screws.

A steel ball is situated at the right end of the intermittent shaft. Beyond this ball is a short plunger which is locked in position by a set screw. To adjust end-play in the intermittent shaft, loosen the set screw, push in on the plunger (not too hard), and tighten the set screw.

The star wheel shaft turns in an eccentric bushing which is part of a bracket that also carries the outer bearing. While this shaft has two bearings and is adjusted by an eccentric, it is a far different arrangement than was used on projectors years ago. Both bearings are carried in this bracket, and they cannot get out of line. There is only one eccentric, not two as formerly. When adjusting the eccentric the bracket swings in a circle, carrying the bearings with it and maintaining positive alignment.

Star and Cam Relation

To adjust for star-and-cam relation, the set screw near the inner bearing is first loosened; then, by means of the two screws which operate against the projection on the bearing bracket, a micrometer adjustment can be obtained by backing off one screw and tightening the other.

The position of the bearing bracket can be adjusted *exactly* as wanted: there is no hit-or-miss procedure as formerly, such as putting a punch into a hole in the eccentric and giving it a haphazard pull.

Care must be exercised during the adjustment so that the star is not forced against the cam too tightly. Terrific force can be applied to these parts when turning the adjusting screw. While slowly turning the screw with a screwdriver in one hand, turn the flywheel back and forth with the other hand, but only a small amount, so that the cam ring is always in contact with the curved sides of the star.

Tightening of the screw must stop the instant that the slightest drag is felt on the flywheel. Back off the adjustment *slightly* so that this drag is completely removed. Now see that the bearing bracket is inward as far as it will go, after which tighten the first-mentioned set screw.

[CONCLUSION]

16-MM INTERMITTENTS

(*Continued from page* 11)

dreds, sometimes thousands, of passages through the projectors in classrooms and TV studios.

It is nevertheless possible to design relatively gentle claw movements, as many of the excellent 16-mm projectors on the current market eloquently attest.

The Operating Noise Factor

The *noise* of certain shuttle-claw movements is a nuisance. Excessive projector noise is intolerable in the classroom, where it interferes with the audibility of the reproduced sound and the mental concentration demanded of the students. Educators would do well to compare the operating-noise levels of the various makes of 16-mm projectors before committing themselves to actual purchase. A reasonably quiet machine that has other desirable qualities is a definite aid to teachers.

Most sprocket movements, including the geneva type, are silent in operation. The noise of a sprocket projector arises mainly from the film loops ("film noise"), inasmuch as the mechanism gears and motor normally make very little noise. It is true, however, that some extraneous noise is created by the lamp-cooling fan in some 16-mm machines.

The slight noise of a well-adjusted

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conventional "heart-cam and shuttle-yoke" type of claw intermittent operating at the normal 3-to-1 pulldown ratio (90-degree movement) is certainly drowned out by the faint whirring noise made by the film loops.

Faster claw movements, such as the 5-to-1 (60-degree) and 7-to-1 (45-degree) movements, are excessively noisy when the increased pulldown speed is obtained *via* sharply angled cams and spring-loaded shuttles which involve the sharp contacting of one metallic surface by another 16 or 24 times a second, or some multiple thereof. The best 5-to-1 claw movements are simply *accelerated* 3-to-1 movements.

Acceleration of the pulldown stroke may be accomplished in a number of satisfactory ways that do not increase the noise of the movement or unduly aggravate normal film wear: eccentrically driven heart-cams which utilize the slipper-block principle;** the use of two cams, one for the horizontal, and the other for the vertical, stroke; and geneva-star driving of the heart-cam.

Rock-Steady Performance Noted

The shuttle-claw intermittent should certainly be retained for most 16-mm projectors because of its extremely rock-steady performance, among other advantages, and because intelligent engineering can effectively minimize its disadvantages. Besides, the adaption of sprocket movements to 16-mm operation is beset by problems of another, and no less vexing, category.

Sprocket movements for 16-mm projectors usually employ sprockets having 8 or 12 teeth. A 4-tooth sprocket (analogous to the standard 16-tooth, 35-mm intermittent sprocket) is too small to work satisfactorily. This is why a scaled-down 35-mm geneva movement is unsuited to the 16-mm field.

Most of the sprocket movements found in commercial 16-mm projectors (including those of European make) are of the "drunk-cam" class. Fig. 4 illustrates the working principle of a drunk-cam and pinwheel combination. Because the "shift" portion of the drunk-cam groove may be differently angled, it is a simple matter to design a drunk-cam intermittent for any desired pulldown ratio or acceleration—deceleration characteristics. Most drunk-cams work at 5-to-1 and 6-to-1 ratios, the most desirable ones for movie projectors.

Many attempts have been made to "gear down" the trustworthy geneva movement by interposing 2-to-1 reduction gears between the starwheel shaft and the sprocket shaft, which carries an 8-tooth, 16-mm sprocket. Since the two gears must revolve intermittently, their meshing and accuracy must be of the highest order, and their size and weight kept down to a feasible minimum. This system is practical, but it operates in the slow conventional ratio of 3-to-1 (90 degrees).

Of greater practicability are the Jackson and Hortson "oscillating-cam" geneva movements, especially the former. The geneva cam of the Jackson movement has a wide face to permit its retraction from the starwheel by a drunk-cam. The starwheel is thus driven by the cam only *at every other* revolution, stepping up the pulldown ratio to 7-to-1 for a 4-sided 35-mm star. By modifying the cam and starwheel, as by the use of eight instead of four slots, an excellent 3-to-1 movement is obtained for use with an 8-tooth, 16-mm sprocket.

The drunk-cam type of mechanism, however, appears to be the preferred movement for 16-mm sprocket projectors. Most European manufacturers employ the drunk-cam sprocket intermittent in a variety of forms for school, auditorium, TV, and other heavy-duty 16-mm projectors. Such machines are extremely quiet, dependable, and kind to film.

**See "Projection with High-Speed Intermittents" by R. A. Mitchell in IP for November 1957, p. 7 *et seq.*

VIDEOTAPE RECORDER

(Continued from page 9)

a linear output from those devices.)

The bias and erase oscillator supplies this high frequency voltage, and also the current to drive the erase head. This is usually a conventional oscillator circuit, whose non-critical frequency of oscillation is four to five times that of the highest audio frequency to be recorded.

The "Playback" Preamplifier

Preliminary amplification of the signal induced in the reproduce head is accomplished in the reproduce (or "playback") preamplifier. You will recall that the output of a reproduce head rises directly with frequency. This increasing output is at an approximate six db per octave rate (a very technical way of saying that the voltage output doubles each time the frequency doubles) so an opposite characteristic is required to obtain a flat overall frequency response. The reproduce amplifier thus contains an "equilization" circuit which attenuates rising frequencies at the same rate that the reproduce head accentuates those frequencies.

Jockeying "Highs" and "Lows"

It might seem silly that we take great pains to record the high frequencies at virtually the same level as the lows, then turn around and knock down the high frequencies during playback. Without going into a long technical treatise on the necessity for this procedure, it can only be stated that (1) it is the only way to realize the full dynamic range of the equipment, and (2) universally accepted record and reproduce curves must be maintained to achieve interchangeability of tapes from machine to machine.

NOTE: The next article in this series will continue the discussion of the basic principles involved in conventional magnetic recording.

Future Articles in The AMPEX Series

Headings for the next four articles in the AMPEX series on Videotape recording and reproduction, to appear in consecutive issues of IP, are:

II. Basic Principles of Magnetic Recording.
III. Basic Principles of Videotape Recording.
IV. Recording and Reproducing the Video Signal.
V. Control Systems and Special Techniques.

Since these articles are almost certain to be retained as a basic reference by the individual subscriber, the many readers who now "share" the other fellow's copy would do well to subscribe to IP on their own. In fact, all IP readers are urged to acquaint their brother craftsmen with the appearance of this series.

SMPTE's Wide-Screen Booklet

"Wide-Screen Motion Pictures," a booklet published by the Society of Motion Picture and Television Engineers, deals with the several new methods of motion-picture production and exhibition that came into use during and after 1952. Of primary interest is a comparison of present-day techniques with those that became "standard" during the nineteen twenties.

The revised edition of the booklet includes detailed information on Sound Pictures, CinemaScope, Cinemiracle, Cinerama, M-G-M-Camera 65, Magoptical Soundtracks, Panavision, Perspecta Sound, Superscope, Technirama, Todd-AO and VistaVision, with specifications for camera aperture, projector aperture, aspect ratio, direction of film travel, rate of film travel, soundtrack, loudspeaker and screen, for each of the methods. A separate section explains the optical principles used in anamorphic systems.

Lists of ASA Standards and SMPTE test films complete the booklet which is available from the SMPTE 55 West 42 St., New York 36, for 25 cents.

Two New Film Standards

A new American Standard for 16-mm Flutter Test Film, Magnetic Type, PH22.113-1958, has just been approved and published by the American Standards Association, The standard specifies a 3000 c.p.s. magnetic sound test film for use in determining the presence of flutter in 16-mm magnetic sound reproducers. Types of film stock, film lengths and identification of film are also covered in the new standard.

The association also made available the revised American Standard for Motion Picture Safety Film, which specifies and defines safety film as applied to motion picture film. Designated *PH22.31-1958*, the revision supercedes American Standard Z22-31-1946.

Copies may be ordered at 35 cents each from the American Standards Association, 70 East 45th Street, Dept PR 49, New York 17, N.Y.

Orson Welles on Technique

Notes on film-making technique by the eminent Orson Welles, writer, actor and producer have him comparing the vigorous use of the old black-and-white aperture with the rigid technical limitations of the new widescreen systems.

Welles described the old methods as "a language, not a bag of tricks. If it is now a dead language," sighed Welles. "I must face the likelihood that I shall not again be able to put it to the service of any theme of my own choosing."

INTERNATIONAL PROJECTIONIST

MAY • 1959

VOLUME 34 • NUMBER 5

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• ROBERT MITCHELL: Focus- and Field Depth of Lenses •

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Monthly Chat

Projection Process Rediscovered

SO DELICATE is the projection process that tolerances of 1/10,000th inch were commonplace in projector manufacture long before the automotive industry achieved such precise workmanship. All the more strange is it, then, that the Theatre Owners of America reacted so violently to the published findings of the survey team of the Research Council, which disclosed that projection image quality in more than 70% of the theatres in the United States was sub-standard.

Now is the moment when IP might well chortle "I told you so," in terms of its unremitting campaign for high projection standards. IP says nothing of the sort; it merely says "we hope so."

The one sure way to accomplish nothing is to delegate a specific task to a committee; but in this instance where the TOA has assembled a group of well-intentioned people representing theatre owners, manufacturers, service organizations, and the organized projection craft to consider ways and means for improving the projected screen image, we may derive, at the very least, some degree of satisfaction from the thought that the exhibition group is selling not real estate, not popcorn, but *motion pictures.*

It would be entirely out of character, of course, if IP should let pass this opportunity to emphasize the incongruity of a situation wherein theatre owners are on the one hand vitally concerned with the *quality* of the screen image the while they pursue inexorably a campaign to reduce drastically projection room manpower. We view with wonderment the statement by George Kerasotes, president of TOA, that he "welcomes" the decision by 20th Century-Fox to provide all of their major releases with "magnetic stereophonic soundtracks." This provides very good sound reproduction indeed; but we wonder if Mr. Kerasotes has considered that a major failing of the reproduction process is the wear of the reproduction head which *tracks* the track.

We can think of no reason to change by a single word the statement made in this space one month short of a year ago, as follows:

"Three-D pictures, anamorphic lenses, 5-to-1 projector intermittent movements; 35-, 65-, 70 and what-have-you-mm film sizes, a gang of different apertures in the projection room; stereophonic, multiple-speaker sound reproduction; 7-track magnetic film prints; short-focal-length lenses impossible of focus, magoptical prints, bum prints due to penurious distributors, 90-foot screens, no exchange inspection . . ."

In short, while they bastardize the reproduction process they constantly seek to "normalize" the manpower level. The projectionist is still some years removed from being displaced by automation in the handling of the fragile ribbon that we term film stock; but signs are not lacking that the exhibitors ardently wish it were so.

We repeat: If the cows in the meadow elected only to chew their cuds and ignore the grass, there soon would be no milk.

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INTERNATIONAL PROJECTIONIST

Volume 34 MAY 1959 Number 5

By ROBERT A. MITCHELL

Is a good lens — the best projection lens that money can buy — a perfect lens? No! Unavoidable optical factors prevent *actual* lenses from behaving like *theoretically* perfect lenses. Here in word and illustration is the reason "why."

Focus- and Field Depths of 35-mm Projection Lenses

A PERFECT lens may be imagined to possess two *infinitely thin conjugate* focal planes—the planes of film and screen in motion-picture projection. No real lens does. A perfect lens may also be imagined to project the image of a point as a point on a screen or photographic film. We used the word "imagined" simply becaues no real lens has these properties.

There are two physical reasons why the behavior of a real lens departs from that to be expected of an imaginary "perfect" lens. First, the nature of light itself precludes the possibility of perfect optical imaging by lenses. Light waves, though tiny, have a *finite* size. Thus, there is a limit to the practicable magnifying power of a lens system. Furthermore, light waves, like ripples in a pond, have a tendency to bend around obstructions in their path. This is called *diffraction*, a term which should not be confused with *refraction*, or the bending of light rays by glass and other transparent media.

Because of diffraction and interference, a point-source of light is imaged by a lens as a small bright spot surrounded by faint concentric rings. The bright central spot, known as an "Airy disc," becomes larger and more diffuse as the diameter of the lens opening is made smaller. This is why astronomers get clearer views of the stars and planets with large telescopes. The wide openings provided by lenses and mirrors of large size produce smaller, more point-like Airy discs.

Image-Blurring Aberrations

The second physical obstacle to the *perfect* functioning of a lens is the presence of optical defects, called *aberrations*, which tend to blur and distort the image in various ways. There are seven aberrations with which the lens-maker has to deal; and even though he can successfully reduce their magnitude to the point where they no longer seriously limit the practical applications of his lenses, he can never get rid of all of them entirely.

Residual aberrations remain to change the focal planes into ill-defined "regions of optimum focus" and to blur the images of points into fuzzy, discolored discs which are usually larger than the Airy discs whose size is an inverse function of lens diameter.

The image-blurring aberrations of a lens reside mainly in the off-axis, or outer, zones of the lens. The enormous lenses of telescopes nevertheless have an extremely low optical speed, so astronomers are not bothered by lens aberrations nearly as much as are cameramen and projectionists.

Camera and projector lenses have high optical speeds and must, accordingly, be highly "corrected" to give clear images. (Cameramen often "stop-down" their lenses to a small diameter to get clearer pictures; but projectionists, always embarrassed for adequate screen illumination, cannot cover up the peripheral zones of their lenses for better focus.)

The "Circle of Confusion"

Owing to the presence of diffraction and residual aberrations, therefore, every *real* lens images a point as a blurry disc. This disc, called the *circle of confusion*, is very small with good lenses but annoyingly large with inferior lenses. This is why an expensive lens usually produces clearer images than a cheap lens of the same size and focal length.

There can be no compromise with image quality in theatre projection,

hence the understandably high cost of acceptable projection lenses can brook no quibbling.

An exceptionally fine projection lens may have a circle of confusion no greater than 0.0005 inch in diameter at the center of the field. This is magnified to only 0.15 inch on a 20-foot screen, or 0.36 on a 50-foot screen. Projection lenses of indifferent quality, especially those of the old Petzval type, have circles of confusion so large that sharp focusing of the picture is impossible.

The image on the film, itself, is never perfectly sharp and its unsharpness is greater than the blur caused by the inherent imperfections of a good projection lens.

As a general rule, a point photographed on film comes out as a disc between 0.001″ and 0.05″ in diameter. On the basis of the smaller value, the point originally photographed is reproduced as a disc having a diameter of 0.29″ + 0.15″ = 0.44″ on a 20-foot screen, or 0.73″ + 0.36″ = 1.09″ on a 50-foot screen. Optical functioning of the photographic-projection process is not always this good.

The foregoing data represent the sharpest resolution that can normally be obtained at the *center* of the screen with the very best black-and-white films and high-quality Gauss-type projection lenses. The circle of confusion becomes larger toward the sides of the screen. The unsharpness of the projected image at the sides and corners of the screen was plainly visible when Petzval lenses of short focus were used. Such lenses were incapable of handling light rays coming into the lens at angles greater than 10 or 15 degrees.

The Question of Focus

Fortunately, the slight amount of blurring inherent in the performance of even the best projection lenses is helpful to the projectionist, rather than otherwise. Even when the lack of perfect image resolution is too slight to be noticed by the audience, it changes the theoretical "focal planes" of the lens into ill-defined, but narrow, regions of optimum focus which allow the film to buckle or flutter to some degree (as it naturally does) without producing in-and-out of focus effects in the screen image.

The distance through which the film may be moved toward or away from the lens without affecting focus on the screen is called the *depth of focus* of the lens, and is usually different for different focal lengths, speeds, and qualities of lenses. The shorter the focal length, the "faster" the optical speed, and the better the quality of a lens, the smaller will be its depth of focus.

There are no simple formulae derivable from theoretical principles by which the depths of focus of different lenses may be calculated. Actual measurement with Gaussian projection lenses of good quality reveals that depth of focus varies between 0.002″ and 0.010″ in the 2- to 6-inch E.F. range. We can, in fact, construct a table (Table I) which supplies fairly accurate depth-of-focus data for 35-mm projection lenses of all speeds and focal lengths, mathematical interpolation furnishing the data for lenses not available for actual testing.

Lenses of *f*/1.9 speed are now generally used in theatre projection. The depth of focus for these is about 0.004″ in the 3″ E.F. range; 0.005″ in the 4-inch range; 0.006″—0.007″ in the 5″ range; and 0.008″ in the 6″ range.

As Table I reveals, there is less difference in depth of focus between the "slow" (*f*/2.5 and *f*/2.3) lenses and the relatively "fast" (*f*/2.0, *f*/1.9, *f*/1.8, and *f*/1.7) lenses than is commonly supposed.

Now, the film bulges, or assumes a pincushion shape, over the projector aperture because the heat generated by the arclamp radiation causes the emulsion to expand more than the film base. The bulge is said to be "negative" when the center of the film-frame is displaced in the direction of the lamp—the normal kind of buckling when the film is threaded emulsion-side toward the lamp.

"Negative" Buckling of Film

Negative buckling is a good thing from the optical point of view because the focal "plane" of a lens is not a flat plane at all, but a curved surface *concave* to the lens. This is called "Petzval curvature," and may be corrected to a greater or lesser degree by selecting the right kinds of glass for the lens elements and by judiciously distributing the optical power

TABLE I. Approximate depth of focus of Gaussian 35-mm projection lenses at center of field.

LENS E.F. (Inches)	SPEED: f/2.5	f/2.3	f/2.0	f/1.9	f/1.8	f/1.7	f/1.5
2	.003″	.003″	.003″	.002″	.002″	.002″	.002″
2 1/4	.004″	.003″	.003″	.003″	.003″	.002″	.002″
2 1/2	.004″	.004″	.003″	.003″	.003″	.003″	.002″
2 3/4	.005″	.004″	.004″	.003″	.003″	.003″	.003″
3	.005″	.004″	.004″	.004″	.004″	.003″	.003″
3 1/4	.005″	.005″	.004″	.004″	.004″	.004″	.003″
3 1/2	.006″	.005″	.005″	.004″	.004″	.004″	.004″
3 3/4	.006″	.006″	.005″	.005″	.005″	.004″	.004″
4	.007″	.006″	.005″	.005″	.005″	.005″	.004″
4 1/4	.007″	.006″	.006″	.005″	.005″	.005″	.004″
4 1/2	.007″	.007″	.006″	.006″	.005″	.005″	.004″
4 3/4	.008″	.007″	.006″	.006″	.006″	.005″	.005″
5	.008″	.008″	.007″	.006″	.006″	.006″	.005″
5 1/2	.009″	.008″	.007″	.007″	.007″	.006″	.005″
6	.010″	.009″	.008″	.008″	.007″	.007″	.006″
7	.012″	.011″	.009″	.009″	.008″	.008″	.007″
8	.013″	.012″	.011″	.010″	.010″	.009″	.008″

TABLE II. "Pincushioning" of film-frames as buckling toward lamphouse.

ARC CURRENT (AMPS.) (H.I. MIRROR LAMPS)	AVERAGE CENTER-FRAME DISPLACEMENT (-)	
	SILVERED MIRROR, NO HEAT FILTER	WITH HEAT FILTER OR "COLD" MIRROR
40 - 60	0.006"	0.004"
60 - 80	0.010"	0.006"
80 - 100	0.017"	0.010"
100 - 135	0.025"	0.015"
135 - 160	0.030"	0.020"

among them. Lenses for 16-mm projection, in which positive buckling is more common, sometimes contain an additional "field-flattening" element.

The negative buckling of film (concave toward the lens) is, as stated, a normal occurrence in 35-mm projection. The *amount* of buckling, however, depends upon the heat absorbed by the film. The more powerful the arclamp, the greater the buckling, all other factors remaining the same. Table II gives the approximate *average* amount of buckling as center-frame displacements for 35-mm triacetate black-and-white film with different ranges of arc current in high-intensity mirror lamps with and without heat filters.

It will be noted that the amount of buckling is 5 times greater for the highest range of arc currents than for the lowest!

As a general rule, the field curvature of modern 35-mm projection lenses conforms almost exactly to the pincushion shape of the film when buckling amounts to 0.005"—0.008". This state of affairs provides a so-called "flat field" in the image plane (screen) with arc currents from 40 to about 80 amperes. At higher arc currents it may often be impossible to obtain a sharp focus at the sides of the screen when the picture is sharply focused in the middle.

Film-Flutter Effects

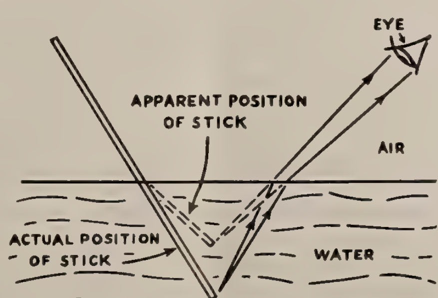
Thanks to depth of focus, the region of optimum sharp focus may be extended quite a distance toward the sides of the screen by projectionists who focus the pictures very carefully *and keep close watch upon the focus at all times to correct for ever-changing "focus drift."*

Let us assume that our lenses give a clear picture in all regions of the screen, and that their depth of focus is 0.004". The film may flutter in and out 0.002" either way from its median location without affecting the appearance of the picture. But when it flutters more than this (which it nearly always does) the flutter will interfere with the focus in various ways.

The rapid film-flutter induced by the rear-shutter light-cutoffs, will, if severe, produce a blur very similar in appearance to that caused by a bad print or a faulty lens. A slower rate of flutter, if the range of film movement be excessive, shows up on the screen as an in-an-out of focus effect which the projectionist cannot possibly follow with the lens-focusing knob.

Film-buckling and flutter can be effectively reduced (although not eliminated entirely) by the use of heat filters or dichroic ("cold") mirrors. Such heat-reducing aids to good projection are mandatory in drive-ins and other large theatres.

We have seen that the depth of focus of a projection lens makes focusing easier by transforming the focal plane at the film into a *region* of good focus. Likewise, there is no "infinitely thin" focal plane at the screen, or image, plane. In fact, the region of sharp focus at the screen may sometimes be many feet in depth. This is called *depth of field*, and should not be confused with the depth of focus we have been discussing.



The displaced image of a stick in water is the most familiar illustration of light refraction.

Projectionists are more concerned with depth of *focus* than with depth of *field*, because the motion-picture screen in a theatre is essentially a flat plane which is usually kept at a definite fixed distance, or "throw," from the projectors. Cameramen, on the other hand, are much more interested in field *depth*. They wish to know at what distances into the background and foreground of a scene objects will be imaged sharply when the camera lens is focused upon the "subject."

"Depth of Field" Considerations

Depth of *field* is somewhat more difficult to understand than depth of *focus*. Even a theoretically perfect lens would image sharply a vast depth of space upon a camera film if focused upon a very distant object! Actual lenses focused upon "infinity" thus include *in the sharpest possible focus* all objects from an infinitely great distance down to a definite finite distance known as the "hyperfocal distance."

As a useful compromise, the short-focus lenses of "fixed-focus" cameras for amateur use are focused upon a distance equal to one-half the hyperfocal distance to permit relatively near objects to photograph sharply the while extremely distant objects remain reasonably distinct.

The field depth of lenses increases with decreasing focal length and optical speed. A short-focus camera lens which has been "stopped-down" to a small opening has a tremendous depth of field. Moreover, the depth of field included in sharp focus increases as a lens is focused upon more distant objects up as far as the hyperfocal distance. At this distance, as stated previously, everything from the hyperfocal distance to infinity is in sharp focus. The lens is then said to be focused on infinity; and if the lens be a simple 1-element lens, the distance from its center to the camera film will be exactly equal to its focal length.

Table III gives the hyperfocal distances of $f/1.9$ projection lenses of various focal lengths, and also the

TABLE III.

Depth of Field of f:1.9 Projection Lenses at Various "Throws"

LENS E.F. (Inches)	HYPERFOCAL DISTANCE	"THROW" (PROJECTION DISTANCE) IN FEET													
		50	60	70	80	90	100	110	120	130	140	150	175	200	225
2	133'	12	14	16	19	23	30	45	80	300	∞	∞	∞	∞	∞
2 1/4	150'	10	11	13	14	17	20	25	30	50	100	∞	∞	∞	∞
2 1/2	167'	9	9	10	12	13	15	18	21	25	40	60	∞	∞	∞
2 3/4	183'	8	8	9	10	11	12	14	16	19	23	30	120	∞	∞
3	200'	7	7	8	8	9	10	11	13	14	17	20	40	∞	∞
3 1/4	217'	6	6	7	7	8	9	9	10	12	13	15	24	60	∞
3 1/2	233'	6	6	6	7	7	8	8	9	10	11	12	17	30	120
3 3/4	250'	5	5	6	6	6	7	7	8	8	9	10	13	20	40
4	267'	5	5	5	5	6	6	6	7	7	8	9	11	15	24
4 1/4	283'	4	5	5	5	5	6	6	6	7	7	8	9	12	17
4 1/2	300'	4	4	4	5	5	5	5	6	6	6	7	8	10	13
4 3/4	317'	4	4	4	4	4	5	5	5	5	6	6	7	9	11
5	333'	4	4	4	4	4	4	5	5	5	5	6	6	8	9
5 1/2	367'	3	3	3	4	4	4	4	4	4	4	5	5	6	7
6	400'	3	3	3	3	3	3	4	4	4	4	4	4	5	5
7	467'	2	3	3	3	3	3	3	3	3	3	3	3	4	4
8	533'	2	2	2	2	2	2	2	2	3	3	3	3	3	3

Field depths in feet. ∞ = infinite depth of field.

Curved-Screen Myth

A *flat* CinemaScope screen appears exactly as "enveloping" as a *curved* one! A curved screen provides no illusion of "depth" because the viewing distances are somewhat beyond the limit of clear stereoscopic perception.

All that screen curvature accomplishes in both conventional and CinemaScope projection is poor focus toward the sides of the picture in some cases, and *gross* geometric distortion of the depicted scenery in *all* cases. Screen curvature *cannot* be conformed either to significant projection angles (in excess of 5 degrees) or to the various angles of view from the audience seating-area.

Any screen manufacturer who asserts that his *curved* screens prevent picture distortion, or are free from the effects of distortion, is misrepresenting flagrantly.

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field depths at various projection throws. It can be seen from Table III that a 3-inch, $f/1.9$ lens, for example, has a hyperfocal distance of 200 feet. The focus adjustment would not have to be altered if the screen were moved farther away than 200 feet, no matter how far; but focus would need retouching if the screen were brought closer to the projectors. [The symbol ∞ used in the table means "infinity;" thus a 3-inch, $f/1.9$ lens cannot distinguish any difference in distance between a screen 200 feet away and one set up on the farthest star!]

Table IV, to illustrate, reveals that the hyperfocal distance coincides with one of the two conjugate foci of a projection lens when the film is brought as close to the lens (considered as a simple 1-element lens) as its *focal length plus its depth-of-focus* distance.

Effect of Screen Curvature

Depth of field becomes a practical consideration for the projectionist when the projection screen is curved. The curvature of wide CinemaScope screens may amount to a "depth" of from 2 to 4 feet in the middle.

According to Table III, a moderate screen curvature will not interfere with focus at the sides of the picture *when film buckling does not exceed the amount tolerated by the field curvature of the projection lens (0.005"-0.008")*. Unfortunately, the film "pincushioning" occasioned by the powerful arcs used in drive-ins and large indoor theatres often exceeds the amount allowed for by lens field curvature and depth of focus.

The result in such cases is a curvature of the image field in the direction *opposite* to screen curvature—a ruinous state of affairs! Unless the screen be bent around *convex* to the audience (which is absurd), the picture will be blurry toward its sides; and the greater the screen curvature *concave* to the audience, the worse the focus will be.

Keep in mind that depth of field is less for the long-focus CinemaScope prime lenses than for the short-focus, non-anamorphic "wide-screen" lenses. Curved screens are therefore more likely to prevent good focus with anamorphic prints than with regular non-anamorphic ones. This peculiar condition is just the reverse of the depth-of-focus problem.

Nothing is gained, and much is lost, by the use of curved screens now that obsolete aluminum-surfaced screens have been largely replaced by modern matte and pearlescent screens. Contrary to the foggy notions of certain theatre outfitters, there is no illusion of "audience surround" when a curved screen is used because the angles of view are not increased one iota.

This "Enveloping" Nonsense

A flat CinemaScope screen appears exactly as "enveloping" as a curved one! A curved screen provides no illusion of "depth" because the viewing distances are somewhat beyond the limit of clear stereoscopic perception.

All that screen curvature accomplishes in both conventional and CinemaScope projection is poor focus toward the sides of the picture in some cases and *gross* geometric distortion of the depicted scenery in *all* cases. Screen curvature *cannot* be conformed either to significant projection angles (in excess of 5 degrees) or to the various angles of view from the audience seating-area.

Projection "On the Level"

Any screen manufacturer who claims that his *curved* screens prevent picture distortion, or are free from the effects of distortion, is going Baron Munschausen one better.*

Good projection demands a minimum of projection angle, the avoidance, where possible, of lenses having focal lengths shorter than 3 inches, and a high-quality *flat* screen which faces the projectors as squarely as possible.

* Baron Munschausen is famed as a teller of fibs.

Multiple-Language A-V Hookup

At the recent Atoms-for-Peace Conference in Geneva, Switzerland, there was utilized a unique visual-aural multiple projection hookup.

Seven RCA 16-mm projectors were installed at the United Nations Building in Geneva, tied in with a special magnetic reproducer with four sound tracks. Earphones and switches were placed at each seat in the auditorium to permit delegates to select the English, French, German or Russian sound track while viewing the picture.

The seven projectors were the RCA Senior sound model modified to operate with the special four-language magnetic sound track system.

TABLE IV. Focal working distances (inches) from film plane for various f:1.9 lenses (considered as simple 1-element lenses.)

LENS E.F. (Inches)	HYPERFOCAL DISTANCE	"THROW" IN FEET 50	75	100	150	200	250	300	350	400
2	133'	2.007	2.005	2.003	∞ 2.002	∞ 2.002	∞ 2.001	∞ 2.001	∞ 2.001	∞ 2.001
3	200'	3.015	3.010	3.008	3.005	∞ 3.004	∞ 3.003	∞ 3.003	∞ 3.002	∞ 3.002
4	267'	4.027	4.018	4.013	4.009	4.007	4.005	∞ 4.005	∞ 4.004	∞ 4.003
5	333'	5.042	5.028	5.021	5.014	5.010	5.008	5.007	∞ 5.006	∞ 5.005
6	400'	6.061	6.040	6.030	6.020	6.015	6.012	6.010	6.009	∞ 6.008

Silicone as a Film — Cleaning Agent

Appended hereto, in part, is a communication from W. Wells Alexander, president of The Distributor's Group, Atlanta, Georgia, bearing on the article "Silicone-Treated Cloth?" by James J. Finn, which appeared in IP for February last (p. 21, et seq.). A commentary on this letter appears immediately following.

To the Editor of IP:

The article "Silicone-Treated Cloth?": I emphatically disagree with some of your statements, and I am quite certain you have used information on silicones which is completely out-of-date. If you will check . . . it is my opinion that you will want to make a correction and perhaps change your recommendations.

For instance, there are many silicone-treated cloths on the market. Only one, the FilMagic Cloth is prepared especially for the treatment of film surfaces. Others contain varying amounts of silicones, and many are also prepared with waxes, anti-static agents, etc., which make them unsuitable for use on films.

Specifications For Use Revised

. . . You perhaps are not aware that since 1957 we have not advised the use of any moisture on the FilMagic Cloth. . . . Today, any moistening of the cloth is contrary to directions for proper use. The use of FilMagic silicones on phonograph records, films or glass surfaces will not produce spotting, and . . . on records has definitely been proved beneficial.

I refer you to a well-known text, "Silicones and Their Uses," by Dr. McGregor of the Mellon Institute (McGraw-Hill, New York) as well as to the official report of the U. S. Naval Research Laboratory, Anacostia. The latter particularly pinpoints test results on lenses as well as motion picture films. As owner of the FilMagic trade-mark, I am interested in seeing that any references to silicone-treated cloth are in accord with the facts.

Your publication goes into the hands of a great number of projectionists in TV and commercial projection situations, and in these fields FilMagic Cloth and our other applications of silicone chemistry have gained wide acceptance. . . . You should point out what tests were made, with particular reference to the fact that within the past several years we have improved FilMagic silicone formulations and applications far beyond the original concepts.

Cumulative Data Available

I shall not at this point attempt to pick out all the flaws in your article, but I shall be very happy to present the facts as they have been proven, or to answer any specific questions as to our FilMagic products in particular.

In order that the several interested parties who have sent me copies of your article may have this reply, I am making copies of this letter to you, since I know that they, too, will welcome any correction or comment you have to make.

ADDENDUM: IP's Rejoinder

IP welcomes Mr. Alexander's comment. Relative to the article under discussion, it was intended to answer in a general way, without mention of any specific product, a not inconsiderable number of inquiries from the field as to the use of such cloths, particularly on film stock and projection lenses.

IP regrets the seeming unfavorable impact of the article upon any specific product; but it also recognizes that expositions of its views on projection matters is one of its chief functions—if not the most important one. Mr. Alexander solicits further comment, so here goes:

The Report of the Naval Research Laboratory in Anacostia ("Project TED NPC PH 4162") on film conditioners is not only self-contradictory in certain respects, but fails to include the film treatments most widely adopted by the professional motion-picture and television industries (e.g., the commercially approved "Permafilm" process described in the *Journal of the SMPTE* 66:12, p. 772 *et seq.*).

Nevertheless, the Navy Report, limited as it is, contradicts the long-maintained claim of the manufacturers of silicone-treated cloths that use of their product minimizes the effect of scratches in film emulsion (Section 16).

The great reduction of photographic density by silicones (up to 10.6% according to Section 19 of the Report) is serious, especially to variable-density soundtracks. The fact of excessive density loss contradicts Section 14 of the Report, where it is stated that no loss of sound gain was observed. (The type of optical track was not specified.)

Permissible Density Losses

Density losses in excess of 0.16 at a density level of 2.00 (1.4%) in release-positive picture and sound images are not generally considered permissible (Turner, Scudder, and Deane, *Journal of the SMPTE*, 67:7, p. 483). The use of silicones on theatre-release prints is thus seen to pose a grave danger to picture and sound quality.

Dr. W. I. Kisner of Eastman Kodak is authority for the statement that a silicone-treated cloth which is too damp leaves an oily streak, or mottle, on the surface of the film, particularly if the film is not wiped in a continuous manner. It is entirely probable that an *unmoistened* silicone cloth leaves much less mottle due to the decreased release of silicone oil; but inasmuch as the Navy report predates the altered instructions of the manufacturer anent wetting these cloths, it is assumed that the Navy wet theirs in making their tests.

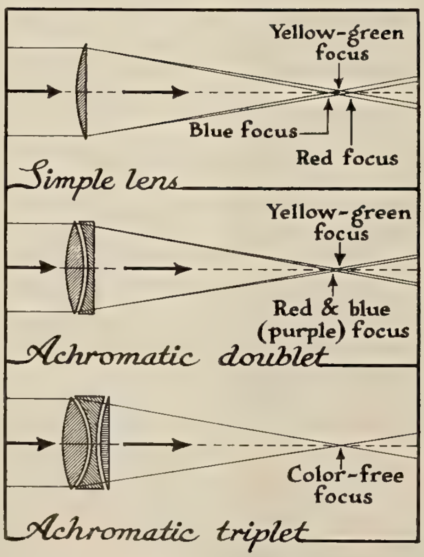
Eastman Kodak also states: "We have not been too partial to the use of liquid silicone solutions for cleaning, since a number of laboratories who have used such materials indicated that troubles were encountered in the way of streakiness, smearing, etc." It may be assumed that a density reduction of as much as 10.6% will result in permanent mottling and streaking of the film if the silicone oil is not applied uniformly.

It has been the experience of commercial film laboratories that silicone-treated film is unfit for contact-printing purposes until the film has been cleaned by approved methods to remove the silicones. The silicones not only increase the occurrence and intensity of interference color patterns ("Newton's rings"), permanently mottling the prints, but may fog the raw stock, as is well known to all manufacturers of film.

Commercial experience confirms Sec-

(*Continued on page 26*)

Lens "Why" and "How"



"Chromatic" aberration is present in all simple lenses because different colors, or wavelengths, are refracted (bent) by different amounts. RESULT: the images produced by simple lenses are fringed with a blur of rainbow colors, the extreme hues of red and blue being most noticeable.

"Achromatic" (color-free) lenses are made by combining convex and concave simple lenses composed of different types of glass. Some achromatic lenses have three components, although the less-perfect, two-component lenses are more commonly used.

The Videotape Recorder

By GEORGE GOODALL

Ampex Corporation

This second in a series of five articles continues the discussion of the basic principles involved in conventional magnetic recording as background material for the video application.

WHILE fundamental operating principles of the record and reproduce heads were touched on when we discussed those components in the preceding article, we must now back up and start filling in some of the holes.

RECORDING: We have seen that the record head consists of a core, formed in the shape of an incomplete ring, inserted in a coil of wire. The discontinuity in the ring forms the non-magnetic head gap in series with the magnetic path of the core. When the magnetic tape bridges the gap, it in effect completes the magnetic circuit.

As the tape moves across the gap the particles of iron oxide assume a permanent state of magnetization proportional to the magnetic flux *at the instant those particles move out of the gap.* The actual recording process therefore occurs at the trailing edge (in relation to tape motion) of the head gap.

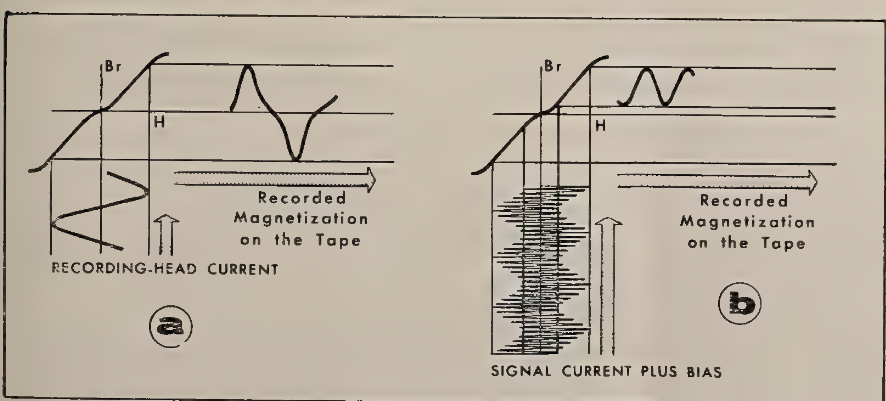
Wavelength of Signal

The wavelength of the signal as recorded on the tape depends upon how far the tape moves during each complete alternation of the signal current. For example, if we were recording 60 cycles at 15 inches per second, each cycle would be recorded on a 0.25-inch segment of the tape; if our frequency were 6000 cycles and our tape speed 7½ inches per second, each cycle would be recorded on a 0.00125-inch segment of the tape. Such computations may be continued for any frequency at any tape speed. The recorded wavelength is very important in the reproduce mode.

BIAS: A seeming tradition of magnetic recording is that no two experts will agree as to exactly *how* the high frequency bias acts to correct distortion. As there is no doubt that it does supply such correction, probably the most simple and straight-forward explanation possible will suffice to show the effect of the bias current, even though it skips blithely over such items as magnetic domains, hysterisis loops, and amplitude transfer characteristics.

Probably the accompanying diagrams show the effect more clearly than words. You will note that near the point of zero magnetization the curve is extremely non-linear, and that extreme distortion is imparted to the input signal. The effect of the bias is to make the signal to be recorded operate only on the straight line portion of the magnetization curve, and the distortion is eliminated.

The actual mixing of the bias and signal is not an amplitude modulation process but is simply a linear mixing of the two frequencies, so that no sum or difference frequencies are created. The wavelengths of the bias signal are too short to be resolved by the reproduce head, thus this current will not be a factor in the playback process.



This diagram illustrates what the high-frequency bias signal accomplishes. "A" shows resultant distortion with no bias voltage applied, while "B" shows how the bias eliminates the distortion.

Bias Setting Important

Because the magnetization curve varies with different tapes, the bias voltage ideally should be adjusted each time the tape is changed—particularly if the change is to a tape from a different manufacturer. However, this would normally be done only when extreme fidelity was required, such as when recording a master tape for a commercial recording company. Usually, a carefully adjusted optimum bias setting will produce excellent results with a wide variety of tapes.

PLAYBACK: In reproducing information from a recorded tape, probably the one most important factor is the dimension of the reproduce head gap. We have seen that the magnetic flux on the moving tape induces a voltage in the head coil; but what actually occurs here is a little more complex than that simple statement implies.

Actually, the flux must travel to the coil through each branch of the head core (forced into that path by the high reluctance of the gap) and must result in a voltage *differential* across the coil if a current is to be created. Therefore, an instantaneous *difference* in the magnitude of the moving flux must exist across the head gap. This means that the gap must always intercept less than one complete wavelength of the highest frequency recorded on the tape. However, if the gap is too small the flux will not be forced through the core to the coil, and signal level will be excessively attenuated. An optimum design, tailored to specific requirements of frequency response and level, is thus necessary.

INHERENT FREQUENCY RESPONSE FACTORS IN MAGNETIC RECORDING

If we assume that we are using professional quality equipment and tape we can disregard the response of the associated amplifiers, the physical aspects of maintaining constant tape speed and good head-to-tape contact, and core losses in the head—all of which are a matter of good engineering design.

There remain certain inherent characteristics which define the frequency limits in any specific magnetic re-

corder/reproducer. While these properties can be varied to meet individual requirements, the overall result must represent an optimum arrangement in which frequency response, distortion, and the necessary signal-to-noise ratio, are interrelated.

These compromises are normally not a problem in conventional audio recording, as the characteristics of the audio spectrum lie almost entirely within the normal boundaries inherent in magnetic tape recording. However, if these boundaries are not delineated it will be difficult to understand the reasoning behind some of the design work on the Videotape recorder. Magnetic recording has fewer limiting factors than any other method of storing sound, but as with all such devices those factors are present and must be recognized.

High-Frequency Response: The primary limiting factors in high-frequency response are the dimension of the gap in the reproduce head, and the resonant frequencies of both the record and reproduce heads.

As we have seen, the actual recording function occurs as the tape leaves the record head gap, thus the dimensions of the record head gap are relatively uncritical. However, as shown on the accompanying diagram, when the recorded frequency rises to a degree where the reproduce head gap intercepts a complete wavelength of the signal on the tape there can be no difference in flux magnitude across the gap, and head output will be reduced to zero. This effect will occur at all multiples of the represented frequency, thus for all practical purposes the head output is useless.

Counteracting the "Gap" Effects

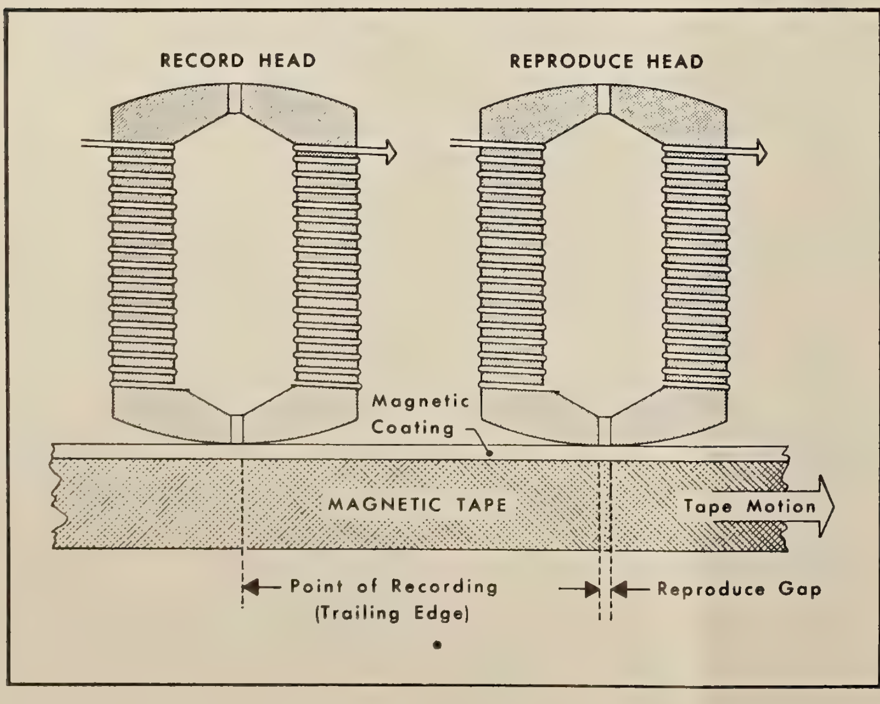
Two methods may be employed to counteract this "gap" effect—either the gap can be made smaller or the record/reproduce tape speed can be increased. We can only reduce the dimension of the gap so far and retain adequate signal levels and realistic manufacturing tolerances; as this point is reached any further extension of high-frequency requirements must be accompanied by a corresponding increase in tape speed.

A faster tape speed, of course, results in a longer wavelength of the recorded signal on the tape. (Higher tape speed also results in a decreased "self-demagnetizing" effect which occurs as opposite poles of individual magnetic fields on the tape come closer and closer together at high frequencies.)

The coils of the heads are inductances which will resonate with actual or distributed capacity in the circuit. Immediately after the point of resonance a sharp drop in head output occurs, thus the resonant frequency must normally be either outside the pass band of the system, or so placed at the extreme upper limit that it actually provides a shelf and extends the response.

As circuit capacitance is reduced to an absolute minimum, only one way remains to place the point of resonance at a higher frequency, and that is to reduce the induction of the head coil by employing a lesser number of turns of wire on the coil. A reduction in the number of turns will adversely affect head output over the entire frequency range, particularly influencing the low-frequency limit, so again an optimum design must be provided.

The action of the record and reproduce heads is different. The recording is done at the trailing edge of the record head gap, while the gap on the reproduce head spans the signal.



Low-Frequency Determinants

Low-Frequency Response: The lowest frequency which can be successfully recorded and reproduced is determined by a combination of the required signal-to-noise ratio, the distortion which can be tolerated, and the bandwidth which must be recorded.

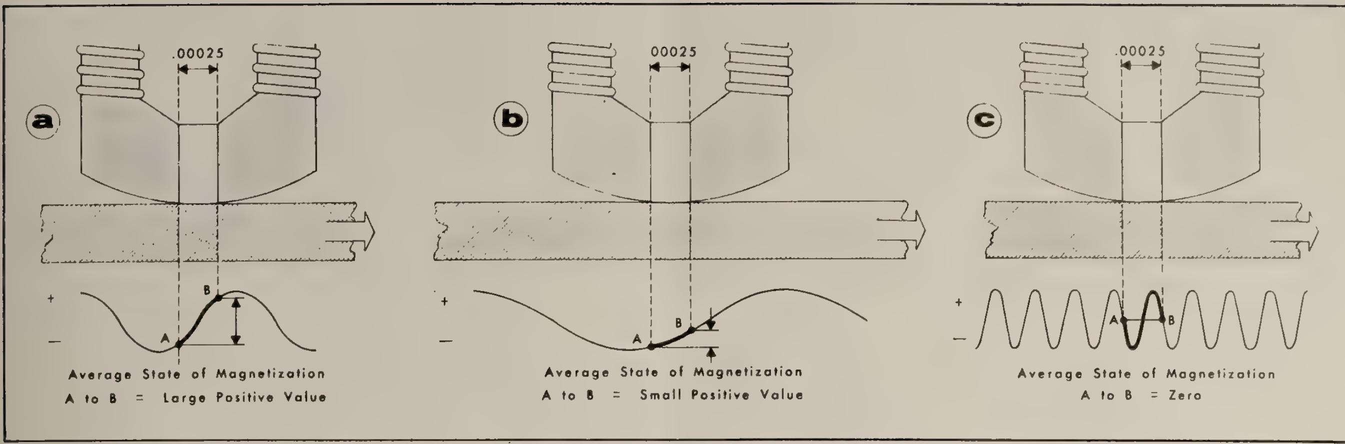
The output of a given reproduce head is proportional to the rate of change of magnetic flux across the head gap. As the recorded wavelength of the signal on the tape gets longer and longer, the rate of change of flux gets slower and slower (assuming a constant tape speed).

Heretofore we have considered that the output of a reproduce head rises directly with frequency; if we stated this same axiom from an opposite point of view we would say that the output of a reproduce head drops directly with frequency. The low-frequency limit is determined by how far we can tolerate this decreasing output while maintaining an adequate signal-to-noise ratio. (It should be apparent that the noise level in associated electronic assemblies will thus affect the low frequency limit.)

Tape Saturation vs. Distortion

If we attempt to increase the record level to compensate for this decreasing head output, we soon reach the point where tape saturation results in excessive distortion.

Bandwidth enters the picture because the six db per octave dropoff in reproduce head output normally starts at the highest frequency which must be reproduced, and is constant regardless of tape speed. If a higher and yet higher frequency requirement is imposed, the low-frequency limit—dictated by the necessary signal-to-



How different frequencies react with the reproduce head gap is shown here. In "A" a medium frequency gives a large output; in "B" a low frequency results in a very small output; and in "C" (where the high frequency has the same wavelength as the gap dimension) there is no output. Sine waves are used here to indicate the average state of magnetization on the recorded tape.

noise ratio—must rise inexorably with it, octave for octave.

A general rule is that approximately 10 octaves is the maximum bandwidth that can be successfully recorded and reproduced by any magnetic tape device.

As noted previously, the limitations of frequency response which we have considered, do not generally apply to audio work. However, as the requirements for higher frequency response and broader bandwidth are extended again and again, we must provide faster tape speeds, very precisely built heads, modulation/demodulation systems, and other means of staying within the inherent limitations of magnetic recording.

[NOTE: The next article in this series will discuss the basic design of the Videotape recorder and describe how conventional recording principles were adapted to make magnetic recording of the television signal possible.]

N. Y. State Projectionists' Spring Meeting

New York State Association of Motion Picture Projectionists will meet in Spring conclave on Monday, May 25, at the Moose Club in Hornell, New York. Chairman Bill Ingram, technical director for the Schine theatre circuit, has arranged a very interesting technical program which will feature papers presentations as follows:

"Prolonging the Life of Motion Picture Release Prints," by Eric C. Johnson, Eastman Kodak Co., accompanied by the showing of the film "Murder in the Projection Room".

"Weather in the Projection Room," by Dr. Fred J. Kolb, Eastman Kodak Co.

"Large-Film Projection in Theatres," by Larry Davee, Century Projector Corp.

On exhibit will be a plastic intermittent movement (operative commercially) with a new-type sprocket, the product of LaVezzi Machine Works, Chicago, Illinois (4635 West Lake St.). See notes appended.

All projectionist organizations in New York State are urgently requested to send a representative to this meeting; in fact, projectionists from any geographical area are invited to attend.

New LaVezzi Intermittent

To the Editor of IP:

The demonstrator intermittent movement assembly is made with transparent plastic case arm flywheel, etc., so that the inner workings are easily viewed. The intermittent is motor-driven so that the action of the star and cam can be witnessed. Projectionists attending this meeting will enjoy seeing it in operation.

The terminology used in the N.Y. State technical program, "new-type intermittent sprocket," is not strictly correct. We recently changed the design of all of our 35-mm intermittent sprockets to eliminate the inner film-riding diameters. This diameter, which always had been maintained at a smaller size than the outer diameter, is considered of little importance in projection, since the film rarely buckles sufficiently to be supported by this smaller diameter.

Removing this section, however, brings about a weight reduction which is always to be desired in an intermittent sprocket, and this is the prime purpose of the change in design.

While this is a change in our line of sprockets, this design has been used previously in experimental work and in some cases on regular production: The elimination of the inner diameter on 16-mm film sprockets has been common for a number of years.—Worth Baird, *LaVezzi Machine Works.*

Kodak's 47th Wage Dividend Highest Ever—$40 Million

A wage dividend of about $40 million was paid last month to about 47,000 Eastman Kodak Co. employees in the United States. The wage dividend recognizes the part Kodak people play in the success of the company, and is based on the amount of cash dividends declared on the common stock during the year and on the recipient's earnings over the five years preceding the payment date. It is paid in addition to regular wages.

The recent payment was the largest since the plan was begun in 1912. Eligible persons will receive $32.625 for each $1,000 they earned at Kodak during the five years 1954-58.

U. S. Film Earnings Abroad

American film industry overseas revenues, for some years hovering around the 50% mark, now have tipped the balance to the point that the foreign returns account for approximately 54%. The rise in the percentage from overseas, it was noted, takes into consideration the greater sales effort made in the countries not yet affected by sizable TV competition, or indeed any competition, plus the drop in domestic earnings, off an estimated $40 to $45 millions in the last eight years.

Tax Killed in Alberta

Alberta has become the second Canadian province to drop the amusement tax on motion picture theatre taxes. Estimated annual loss in revenue to Alberta is put at $425,000. Saskatchewan earlier dropped the provincial tax on admissions, but permits its municipalities to collect a tax for themselves.

WIDE SCREEN
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AUDIO-VISUAL
EDUCATIONAL • INDUSTRIAL • COMMERCIAL

Prime Factors in Disc Sound Quality

THERE'S no denying the convenience, economy, and educational utility of phonograph records for permanent collections of recorded sound. Thanks to the use of smooth, unbreakable plastic and to technical improvements in record-manufacturing processes, "high-fidelity" discs for music, drama, language, and social--studies courses are now a commonplace.

Unfortunately, the worn-out, damaged, and improperly adusted record players used in many classrooms fail to reproduce the excellent sound quality inherent in modern recordings. Obsolete phonographs should be replaced, and newer models maintained in first-class condition by the immediate replacement of parts which have outlived their usefulness. Needles are usually kept in service too long; and defective pickup cartridges and amplifier tubes are much too prevalent. A good instrument deserves the chance to give its best performance at all times.

Frequency Response Factor

The selection of a new record player for school use requires careful thought and attention to specifications. It is not too much to insist upon a reasonably level frequency response from 40 or 50 cycles to 10,000 cycles, with some degree of response up to 15,000 cycles when the tone control is turned to treble. Individual bass and treble controls are highly desirable; and the loudspeaker units should have separate channels for the bass and treble frequencies ("woofer" and "tweeter" speakers).

The instrument should be fitted with a rugged, high-quality pickup which carries a turret mount for regular and microgroove needles. It should be able to play 78-, 45-, 33-1/3-, and 16 rpm ("talking-book") records with accurately controlled turntable speeds and without flutter or "wows." The machine should make no noise when the motor and amplifier are switched on.

The best and most widely used record speeds for educational recordings are 78 and 33-1/3 rpm, the former having been established by old-style "standard" records which are still widely used because so many of them are invaluable and irreplaceable. (Rare 78-rpm records of value can be rerecorded on 33-1/3 rpm microgroove discs by firms specializing in this service. The originals may then be stored for preservation.)

The older "transcription-type" 33-1/3-rpm records had standard 3-mil grooves and played from the inside out. Modern "long-play" 33-1/3-rpm discs have 1-mil microgrooves and play from the outside—in like all commercial records. Students using the apparatus should be cautioned always to use the correct type of needle for the records played.

Tracking Stylus Vital

The pickup needle, or stylus, is the most obvious component affecting sound quality. All needles, even those having diamond points, wear out with use. Dusty, gritty records wear needles very rapidly, hence the need for storing records in paper envelopes and periodically cleaning those most frequently played by means of a record brush.

Do not wipe 78-rpm shellac records with silicone cleaning cloths!

A worn phonograph needle increases surface "hiss," distorts the sound, and may damage the record grooves. A new needle, 3-mil or 1-mil, has a polished, *rounded* point which may be made of osmium alloy, synthetic sapphire, or "carbonado," an impure form of diamond. The metal points have the shortest life, and the diamond points the longest life. Some authorities prefer sapphire needles because of their moderately long life and kindness to records. Slightly worn diamond needles are ruinous to the record grooves.

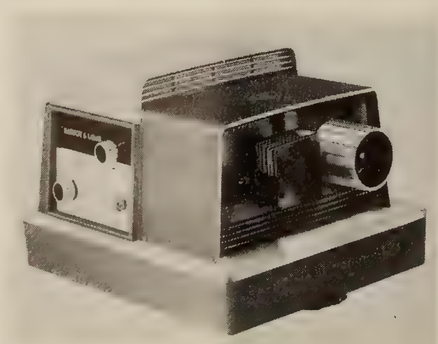
After playing from 50 to 1,000 records, the rounded point of a phonograph needle wears down to a flat surface. A very small "flat" does not noticeably affect sound quality, but a wide "flat" introduces distortion by failing to track the wavy grooves accurately. A needle which has worn down to a sharp chisel-shaped edge may actually cut through the finer groove waves (treble tones) and ruin the records.

The accompanying illustrations may serve as a guide to indicate when needles should be replaced. Do not rely on listening tests, but remove the needle from the pickup

New B&L Balomatic "305"

BAUSCH & LOMB announces the addition of a new 500 watt automatic model to its present line of popular, Balomatic slide projectors. Known as the Balomatic "305", the new projector shows up to forty 2″ x 2″ slides with just a touch of a button to change each one. Projector features high picture fidelity and slides always stay in focus. Controls are conveniently grouped on a single, illuminated panel. Remote control is available as an accessory.

The Balomatic "305" lists at $99.50, complete with 40 capacity non-spill tray and light-weight carrying case. Additional slide trays at $1.25 each. Projector is finished in two-tone gray, chip-proof baked enamel. UL-CSA approved, it carries a life-time guarantee. Bausch & Lomb Optical Co., 635 St. Paul Street, Rochester 2, New York.



The new B & L Balomatic "305" with 500-watt lamp finger-tip operation and constant focus.

and examine it under a low-power microscope. View the point from the side of the needle to see the "flat," if present. Compare it with a discarded needle known to be too worn for use.

Types of Pickup Cartridges

The pickup cartridge is a sensitive electro-mechanical device which is too often subjected to unnecessary abuse. It can be injured, or even ruined, by scraping the needle across the record grooves or dropping it upon the record in a rough manner.

Rochelle-salt crystal cartridges (a common type) are especially delicate. Because Rochelle salt deteriorates by losing one molecule of water of hydration at about 160° F., manufacturers recommend keeping such pickups cooler than 125° F., and not playing them at temperatures in excess of 100° F. They should also be protected from moisture, inasmuch as Rochelle salt is very soluble.

Ceramic cartridges work on the same "piezoelectric" principle, but are more rugged. Magnetic pickups, including the "variable-reluctance" type, are extremely dependable and seldom wear out if not grossly misused.

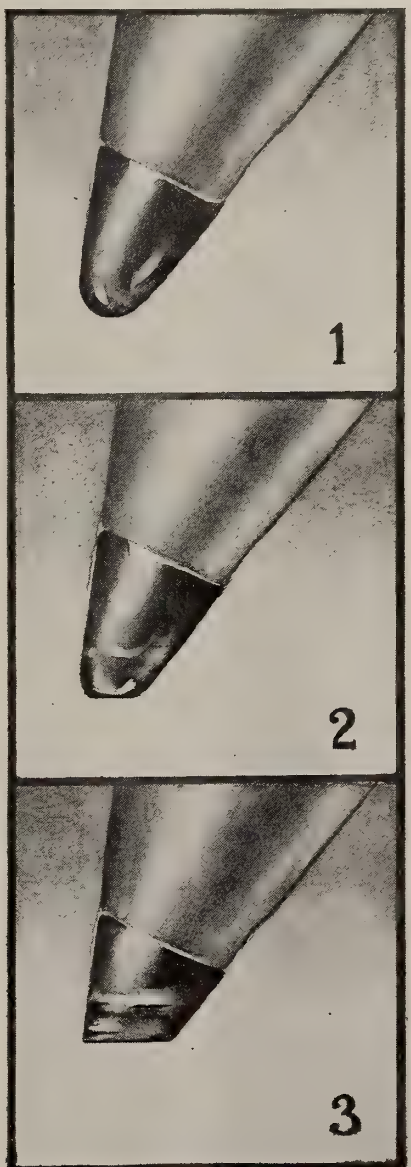
A deteriorated crystal pickup gives "thin," scratchy sound with poor bass response and random variations in volume. A cracked crystal gives no sound reproduction from the records, but generates grating, crackling noises. Crystal cartridges are inexpensive and easily installed, so bad cartridges should be replaced without delay.

Defective Amplifier Tubes

A worn-out amplifier tube can spoil the sound as readily as a bad pickup. In fact, we think of the tubes in cases of weak, "mushy" sound after a preliminary inspection of the needle. Unless the filament has burned out, a rare occurrence which prevents both the bad tube and others connected in series with it from lighting up, a bad tube cannot be told from a good one by its appearance. The blackish or silvery coating on the inside of the glass envelope has nothing to do with the condition of a tube.

A defective tube is best located by the simple process of substitution. Each old tube is, in turn, replaced with a new one until the sound quality improves. The so-called "power" tube (there may be two of these in larger amplifiers) ordinarily has the greatest influence on sound quality. This is the tube which is connected to the output transformer supplying the speakers. The power and rectifier tubes are the ones that get warmest when the amplifier is turned on, and they may be told apart by the relatively simple internal structure of the rectifier tube.

Loudspeakers of good quality do not deteriorate unless subjected to excessive heat or moisture or rough handling which may damage the paper cone. The cones of dynamic speakers are easily dented and torn. Speaker damage of this kind absolutely precludes satisfactory reproduction, and calls for factory repair.



Progressive wear of a phonograph needle as revealed by a low-power microscope. Fig. 1 shows the polished, rounded point of a new needle. The friction of the record groove gradually wears a "flat" in the point. When worn to the extent shown in Fig. 2, the needle should be replaced to avoid sound distortion and record wear. Fig. 3 shows a needle which has been left in service too long. The worn "chisel edge" scrapes the record grooves.

Care of Loudspeakers

In very rare instances a voice coil becomes open-circuited because of a broken wire. The voice coil may burn out if accidentally connected to an incorrectly wired amplifier or to the field-coil terminals of old-style amplifiers. Modern speakers have permanent field magnets instead of electromagnets, and so have only voice-coil terminals.

Tighten all screws in baffles and speaker cabinets to eliminate rattles. Do not place records, pencils, tools, or bric-a-brac on speaker cabinets. If portable phonographs are played too loudly, the powerful speaker vibrations may cause the amplifier tubes to emit metallic rattles or ringing noises.

Proper Acoustical Balance

The best reproduction is obtained in acoustically "dead" rooms having an abundance of sound-absorbing material. "Live" rooms, large and bare, permit echoes to confuse the sound. Contrary to prevalent opinion, the acoustical defects of a live enclosure cannot be corrected by altering the bass-treble response with the tone control. The primary purpose of the tone control is to balance the sound reproduction obtained from records of different frequency characteristics.

As a rule, musical recordings tolerate a fairly strong bass response, but speech becomes unintelligible and "boomy" when the bass is too strong. The "needle hiss" of old 78-rpm discs can be reduced by sacrificing some of the treble. Only listening tests can determine the best bass-treble balance for any given record.

It is suggested that the condition of all classroom record-playing apparatus be thoroughly checked and restored before the opening of the fall semester.

* * *

Nylon Pegboard Clip

A NEW PEGBOARD CLIP, molded completely of nylon, has just been introduced by the Norton Laboratories. The clip, ideal for fastening pho-

tographic or display materials to pegboards can be used by photographers, art studios, advertising agencies, offices, department stores, libraries, and schools.

The clip has four molded pegs on the reverse side which fit the hole spacing in standard pegboards. The clip is fastened to the board by simply pressing the pegs into the holes. An offset on the face of the clip provides a lip for holding the display material to the board. The pegs are split and slightly tapered to provide a secure fastener. Norton Laboratories, Lockport, N. Y.

The punch will take both the 127 and the 120 size films. The larger transparencies allow considerable leeway in cropping, one of the original advantages of the system. Price: $9.95. Through dealers, or address B. Brooks, Inc., 10 West 46th St., New York, 36, N. Y.

* * *

Machine Teaches as Socrates Did

Device Asks Questions and Also Gives Answers

Fifty students at Hamilton College in Clinton, N. Y., are getting the rudiments of a course in logic by machine in an experiment to see whether a gadget can do part of a professor's job. The Ford Foundation has made a two-year grant of $204,310 to the college to enlarge its work with self-teaching machines and materials for the logic course and for others in mathematics, psychology, French and German.

These courses will be tried on a summer school group of gifted high school pupils in Oneida County and next September on 250 to 300 Hamilton students.

Unchangeable Answers The Key

The machine is a box about two feet wide with two windows. In one window microfilmed questions appear, one at a time. In the other there is a section of paper tape on which the student writes his answer. He then moves a lever, which covers his answer with a transparent shield, so that he cannot change it. At the same time the correct answer appears in the question window.

The teaching technique requires the breaking down of the problems or materials into their smallest parts, then employing the Socratic method, teaching by leading questions, to guide the student through it step by step.

This is easier to do with a subject like logic, which involves comprehending an idea, than it probably will be with expository material, said John Blyth, Professor of Philosophy at Hamilton, who is devising the logic course.

After the student has learned the new material by answering questions that "feed in the material," he reads the text. Class lecture and discussion of application of the concepts comes last.

Teachers Benefit, Too

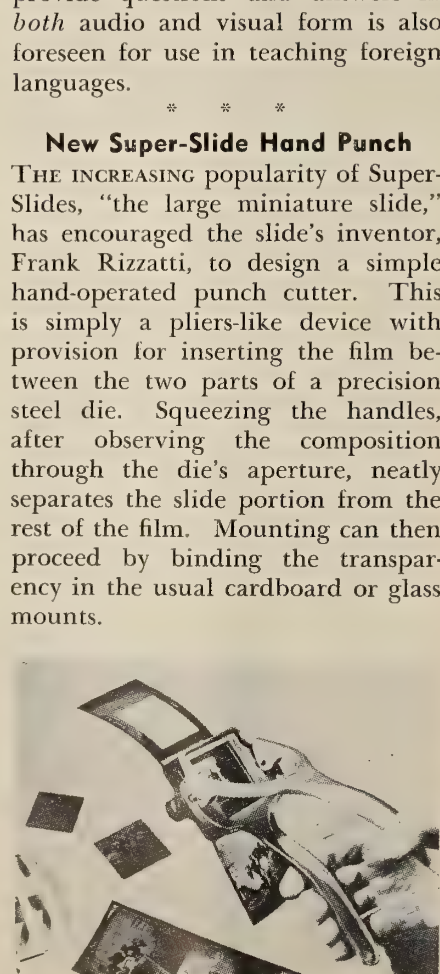
Professor Blyth said that using the self-teaching machines amounts almost to a game at which the students want to succeed. "I've never seen students work so hard," he said, "or give sixty minutes of full attention."

The film-strips which Blyth developed this year for use in the logic course each contain 60 questions and answers. Development of more complex machines which will provide questions and answers in *both* audio and visual form is also foreseen for use in teaching foreign languages.

* * *

New Super-Slide Hand Punch

The increasing popularity of Super-Slides, "the large miniature slide," has encouraged the slide's inventor, Frank Rizzatti, to design a simple hand-operated punch cutter. This is simply a pliers-like device with provision for inserting the film between the two parts of a precision steel die. Squeezing the handles, after observing the composition through the die's aperture, neatly separates the slide portion from the rest of the film. Mounting can then proceed by binding the transparency in the usual cardboard or glass mounts.



Super-Slide hand punch.

Polacoat's giant Army screen.

Polacoat's New Lenscreen

Answering the need for large daylight rear projection screens to be used in lighted auditoriums, meeting halls, gymnasiums, and large assemblies, Polacoat has perfected the Flexible Lenscreen, Type LS60F. This is an elastic latex-vinyl plastic produced on specially built continuous machines. Screens of the new material are laced, hooked, or snapped onto surrounding frame supports. The picture image is received from projection equipment behind the screen. Picture contrasts are quite good even when the audience area is in full illumination. When not in use the screen can be unmounted easily and stored away in a compact package.

The Lenscreen, formerly available in limited sizes and more rigid materials, is now suited to the more versatile large size applications. Sizes range from 3 by 4 feet up to 40 by 80 feet. The larger sizes are required for television staging, film production, or gigantic background stage effects. Screens are seamless to 10 feet high. Sizes beyond this are edge welded from endless rolls of the special plastic.

Advantages favoring the use of rear type projection make the use of the new Lenscreen popular in education. These include the elimination of the projection aisle, removal of distracting projection equipment from the audience area, and freedom from unwanted shadows cast upon the screen when mem-

bers of the audience or the instructor accidently cut into the projection beam. Polacoat, Inc., 9750 Conklin Road, Blue Ash, Ohio.

* * *

New Kodak Teaching Film

THE ROLE of audio-visual materials in today's elementary and secondary education is outlined for laymen and educators in a new Eastman Kodak informational film, "Pictures Teach at Penfield." The 19-minute motion picture, on Kodachrome Film and in sound, focuses on the Penfield, N. Y., Central School District, where films, slides and filmstrips are integral parts of every curriculum. The lively interest and sense of participation which a student gains from audio-visual resources are demonstrated through the reactions of a brother and sister to learning by film. "Pictures Teach at Penfield" analyzes a wide range of contributions to learning which can be made by a professionally-conducted program of audio-visual education.

In the color-and-sound film "Pictures Teach at Penfield," all teachers and students play themselves. Actual school locations were used —classrooms, laboratories, etc.

Students and teachers play themselves in the new motion picture. which was photographed in classrooms and laboratories. A print is available on *free loan* for showing to groups interested in education. Write to Audio-Visual Service, Eastman Kodak, Rochester 4, N. Y.

* * *

RCA New Orleans Distributor

AUDIOTRONICS SUPPLY Co., 1500 Saint Bernard Avenue, New Orleans, La., has been appointed a distributor for RCA engineered sound products. The firm will handle the installation of all types of RCA sound and intercom systems, including equipment for home, office, plant, theater and school use.

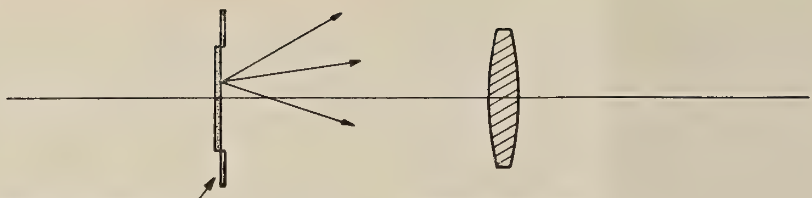


Fig. 3A. Extended-source illumination system.

Viewing the Projector as an Integral Optical-Mechanical System

By HAROLD E. ROSENBERGER

Bausch & Lomb Optical Company, Rochester, N. Y.

The third and penultimate article in a series which has discussed various components of the motion picture projector and now considers the purely optical units of the system. This series was excerpted from a paper originally presented before the Society of Motion Picture and Television Engineers.

THUS far we have referred to the components of the anamorphic attachment simply as positive and negative cylindrical lens elements without regard to their focal lengths. As it turns out, fortunately from an economic point of view, the focal lengths of the cylindrical elements are not dependent upon the focal length of the projection lens. This means that a *single* anamorphic attachment can be used for a *series* of projection-lens focal lengths.

To obtain a given horizontal magnification from the anamorphic attachment requires only that the ratio of the negative focal length to the positive be equal to the desired horizontal magnification. Thus, in the actual case of CinemaScope projection where 2× horizontal magnification is required, the focal length of the positive cylindrical lens is twice that of the negative lens.

Focal Length a Compromise

The actual choice of focal length, e. g., whether the positive be +50 and the negative —25 mm, or whether the positive be +200 and the negative —100 mm, has to be decided on the basis of a *compromise* between image quality, bulk and cost.

As was shown in Fig. 2B, to obtain an in-focus image on the screen requires that the negative lens push the near focal plane formed by the positive lens back to the far focal plane. Since the far focal plane will always be made to fall on the screen by adjusting the projection lens, and since this screen-to-lens distance will vary from one theater to the next, it becomes necessary that provision for focusing the anamorphic attachment be included in the mechanical design of the attachment.

If we turn the anamorphic attachment around so that the negative lens faces the projection lens, we find that where previously we had a 2× *gain* in horizontal magnification we now have a 2× *reduction.* If now we rotate the anamorphic attachment 90° about the axis of the projection lens so that the axes of the cylinders lie in a horizontal plane, we will again have the same width-to-height ratio that we had before reversing the attachment, but the picture dimension will be reduced to half the original dimensions.

Use of Reversed Anamorphic

When projection lenses of the required speed and focal length exist for normal anamorphic projection, there is no advantage in using the reversed anamorphic. For installations where the projection throw is abnormally long and where the projector head limits the speed of the long-focal-length lenses required, a definite gain in screen illumination can be had by using the reversed anamorphic.

The focal length of the projection lens used with the *reversed* anamorphic will be exactly half the focal length which would have been required for normal anamorphic projection to produce a given picture size.

Screen Illumination Systems

The projection lens and anamorphic attachment, in order to perform their assigned task, must be backed up by an adequate illumination system. From the standpoint of getting the most light on the screen, the ideal illumination system is that shown in Fig. 3A, consisting simply of a surface which radiates uniformly in all directions, which is large enough to cover the entire film gate area, and which has a surface brightness adequate to provide whatever screen brightness is required.

It is to be noted that even this system falls short of being ideal from an overall consideration, since only a small fraction of the energy passing through and heating the film will serve as useful screen illumination; however, such a system would perform equally well without any kind of adjustment for projection lenses of all speeds and focal lengths and would improve the distribution of illumination on the screen to the point where only the vignetting within the projection lens and anamorphic attachment would prevent perfect uniformity.

Arc Brightness, Size

Since we are unable to make a source which simultaneously meets the requirements of size and brightness, we are forced to add optical components to our illumination system in order to overcome the shortcomings of the sources we have available. We shall confine this discussion to the carbon-arc source and shall use a lens-

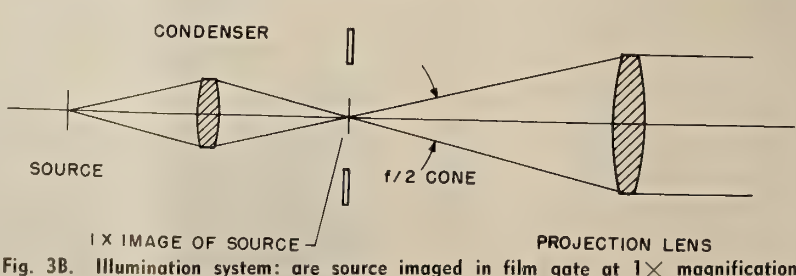


Fig. 3B. Illumination system: arc source imaged in film gate at 1× magnification.

condenser system for the sake of clarity in the illustrations.

In the carbon arc we have a source of sufficient brightness, but not of sufficient size, so the task of the condenser is to increase the size of the source optically without a reduction in brightness.

Referring to Fig. 3B, consisting of an $f/2$ projection lens, a film-gate area to be covered which is several times the area of the arc source, and a condenser lens which is adjusted to image the source in the plane of the film gate at 1X magnification at a speed of $f/2$.

No illumination is provided in the outer regions of the gate, but from the center of the gate the projection lens receives the same amount of light as it would receive if the source were physically located in the plane of the gate (minus the small transmission losses in the condenser).

Suppose, now, we double the size of the source image by increasing the condenser magnification to 2X. This requires that the condenser be moved backward away from the gate and, consequently, to maintain the $f/2$ speed on its image side requires that the condenser be made larger in diameter, as shown in Fig. 3C.

Now, as we have seen, the relationship between the f/numbers at which a lens works on its object and image sides is given by:

$$f/\text{Number (Object Side)} = \frac{f/\text{Number (Image Side)}}{\text{Magnification}}$$

Since the condenser is working at $f/2$ on its image side at 2X magnification, its f/number on its object side is $f/1$. This means it is now receiving *four times* the amount of light it had previously received, but since its magnification has been doubled, the source image is now just four times its previous area; consequently we have increased the size of the illuminated area without any change in illumination on the central portion of the gate.

[TO BE CONCLUDED]

Are You Moving?

If so, please notify us one month in advance. The Post Office does not forward magazines. To avoid delay, please cooperate by sending us both your *new* and *old* address.

LETTERS TO THE EDITOR

"Inkies" vs. Carbon Arcs in 16-mm Projection

To the Editor of IP:

THE ARTICLE by Robert A. Mitchell in your February issue: "Projection Screens for 16-mm Showings." We have manufactured for approximately 20 years a 30-ampere carbon arc for use with 16-mm projection. I feel that Table 2 in the aforementioned article does not seem to give the carbon arc its due.

There is general agreement among other manufacturers of this size arc for 16-mm projection that the lamphouse will deliver approximately 2600 lumens to the screen *without* shutter running—and if an assumption is made that the shutter transmission is 66%, this would result in a *net* to the screen of about 1700 lumens.

[NOTE: Table 2 in Mr. Mitchell's article, referred to by Mr. Hatch, is reproduced here.]

TABLE 2: Recommended picture sizes for 16-mm projection on matte screens.

POWER OF PROJECTOR LIGHT	MINIMUM PICTURE WIDTH 20 footlamberts	RECOMMENDED PICTURE WIDTH 10 footlamberts	MAXIMUM PICTURE WIDTH 5 footlamberts
300-W Bulb	1' - 1½'	2'	2½' - 3'
500-W Bulb	1½' - 2'	3'	3½' - 4'
750-W Bulb	2½' - 3'	4'	5' - 6'
1000-W Bulb	3' - 3½'	5'	6' - 7'
1200-W Bulb	3½' - 4'	6'	7' - 8'
30-amp. Arc	6' - 7'	10'	12' - 14'

Using Mr. Mitchell's Table 2, we note the recommended picture width for 10-foot lamberts is 10 feet wide, seemingly indicating that about an area of 90 square feet would be illuminated by these 1700 lumens—an average of about 19-foot candles *incident* light. This would undoubtedly be distributed so that there would be approximately 23-foot candles in the *center* of the picture, and 14 at the *sides.*

Even with a screen reflectivity as low as 75%, there would be a brightness of more than 17-foot lamberts at the center, if the screen were 10 feet wide.

We usually recommend that satisfactory projection will be obtained with arcs with screens up to 20 feet wide, and we know of instances where quite acceptable projection has been obtained with 30-foot screens.

I'm sure that you are interested in giving the carbon arc all that is due it; but in this instance its power as compared with the incandescent is not given due credit.

ARTHUR J. HATCH
President, Strong Electric Corp.,
Toledo, Ohio

Response by R. A. Mitchell

I AM INCLINED TO AGREE, in the main, with Mr. Hatch's estimates, although all manufacturers of 16-mm projectors specify a light output of 1600 lumens, *not* 1700, when 30-ampere arcs are used with 66% shutters and *f*/1.6 coated lenses.

However, several factors prevalent in ordinary field use impelled me to *decrease by a slight amount* the estimate of light output issued by Strong, RCA, etc.

First, the optical condition and operation of such portable arcs often leave much to be desired, measured light output often being less than one-half of that asserted by the manufacturer. Second, the light transmission of 16-mm projector lenses *other than* the standard *f*/1.6, 1½-inch and 2-inch coated lenses is often less than one-half the standard.

Even with coated lenses, an *f*/2.4, ½-inch lens transmits only 44% of the standard amount of light; a *f*/2.0, ⅝-inch lens only 64%; an *f*/2.0, 1-inch lens only 64%; an *f*/1.8, 2½-inch lens 79%; an *f*/2.0, 3-inch lens 64%; a *f*/2.5, 3½-inch lens 41%, and an *f*/2.8, 4-inch lens only 33%. These values were obtained from RCA.

If I had assumed the existence of *optimum* optical and electrical conditions *at all times,* I would have used my computed values of four to five feet for 20 foot-lamberts, 13 feet for 10 foot-lamberts, and 14 to 16 feet for 5 foot-lamberts of average picture brightness on matte screens. These values, of course, would have been very close to those claimed by Mr. Hatch.

In all such cases I prefer to depend on *averages* of measurements made under conditions of *actual use* rather than to give the highest possible values and lead

readers to expect that they can always obtain such values.—R. A. Mitchell.

Rejoinder by Mr. Hatch

Having reviewed Mr. Mitchell's comments, I am sure that you will appreciate, as the average reader undoubtedly will, that when Mr. Mitchell mentions that one does not get the light with the longer-focal and other variations in lenses, such remarks apply with *equal* force to incandescent. My basic contention is that there still remains a vast difference between the illumination obtainable from the carbon arc and that of the incandescent, and greatly more so than acknowledged in Mr. Mitchell's article.—Arthur J. Hatch.

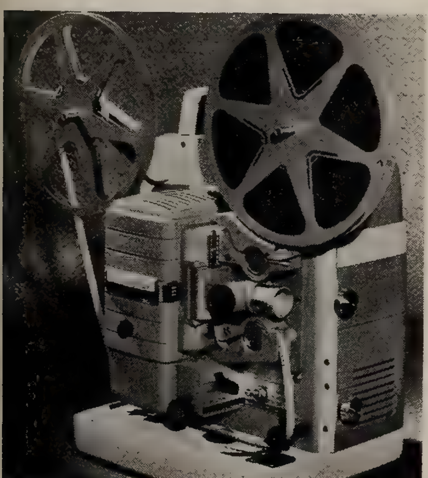
16-mm Wrapup Article "Tops"

To the Editor of IP:

Have just reread the article "Handling and Projection of 16-mm Sound Motion Picture Film," by Robert A. Mitchell, which appeared in your December last issue. It is the best article I have ever read on 16-mm film. It covers everything thoroughly. Wonderful!

I agree that video tape will soon be the basic presentation medium for TV, which seems to have been proven by those stations using this medium for commercials with, I understand, very good results. We can benefit by a down-to-earth medium such as IP.

Edward Fowler
WLBZ-TV, Inc., Bangor, Maine



New automatic self-threading 8-mm projector by Bell & Howell is the Super Auto Load, which puts 25% more light on the screen than conventional 8-mm projectors. Unit uses new Sylvania T-12 lamp with built-in light reflector and thicker filament with only 150-watts of power. Special transformer permits lamp to create more light with one-third the power of standard 500-watt lamps. Super Auto Load also features variable speeds to match original camera taking speeds. Retail price: $139.95.

SMPTE ABSTRACTS

Three papers of particular interest to the projection field were presented at the recent convention of the Society of Motion Picture and Television Engineers at Miami, Fla. Brief summaries of the contents of these papers are appended.

HORIZON SAG COMPENSATION FOR PROJECTION ANGLE

The combination of the curved screen used by several motion-picture processes, the high angle of projection of many theatres and the low angle of view from the auditorium of these theatres to the screen causes a phenomenon termed "horizon sag." This paper describes an optical projection system designed to eliminate, or significantly reduce, the "horizon sag" as observed on the screen from the auditorium of the theatre.—John D. Hayes, head of the photographic department, Bausch & Lomb Optical Co.

OPTICAL CHARACTERISTICS OF REAR PROJECTION

Rear-projection screens of low reflection reduce the effects of light on the screen and allow increase in the ambient light. Goniophotometric curves and setup of screen are given. Distribution, gain, reflection and resolution are discussed as factors. The physiological effects of increased ambient light are considered. The brightness of the picture should at least equal the level of the surrounding light to which the eye is adapted.—John F. Dreyer, president, Polacoat, Inc.

STANDARDIZED 16-MM PROJECTOR

The 16-mm Sound Projector was established by the Projection Equipment Committee under Standardization Working Group 402-40E of F. S. C. Group 67. The transition from three different projectors used by the Army, Navy and Air Force to a single projector was accompanied by design improvements for the new projector.—George W. Reutell, project engineer, Bell & Howell.

New Genarco A-V Catalogue

Now available is a new catalogue describing the complete line of audio visual equipment made by Genarco. Treated in particular detail are the 3000-watt slide projectors in various models and also the electric slide changers for 3¼ x 4 slides which may now be mounted on all makes of slide projectors.

The catalogue may be obtained by writing to Genarco, Inc., 97-04 Sutphin Blvd., Jamaica 35, New York.

Rear-Projection Screen Slight Seen

To The Editor of IP:

Your February article on "Projection Screens for 16-mm Projection" (page 5, *et seq.*,) is excellent, Mr. Mitchell having put together data on screens which has been needed for some time.

Rear Projection an Essential?

We regret that he did not include rear-projection screens. His article actually points up the need for rear projection. In Fig. 1, for example, he actually recommends facing the audience into the light. It is well known that facing into the light is hard on the eyes. With rear projection it is preferable that the screen, not the audience, face the light.

Furthermore, for note-taking and group discussions during projection the need for room illumination makes it desirable that a rear-projection screen be used, as its low front reflection is not washed out by normal ambient light. Rear projection screens are offered in gains of 150, 300, and even 500, thus the correct light distribution pattern can be chosen to fit the use. Their use is growing fast.

John F. Dreyer, *president*
Polacoat, Inc., Blue Ash 42, Ohio.

Reply to the Foregoing

Rear-projection screens were not included in the aforementioned article because their classroom use is neither general nor adaptable to standard practices. Moreover, many of the educational authorities interviewed by the author feel that the small area of the usual commercial rear-projection outfit militates against the best utilization of sound-film materials and limits the size of the viewing audience too severely.

If a light-box be used between the projector and the screen, as it should be to preserve low values in the projected images, the bulk of the device together with attendant storage and transportation problems only increase the preference of teachers for standard projection by reflection in adequately darkened rooms.

Specific Applications Endorsed

The writer hastens to add, however, that the rear-projection outfit possesses uniquely valuable utility in special areas. The projection of microscope slides in science classes is a good example. The enlargement by opaque projection of student-prepared materials is another. These, however, are examples of "discontinuous" materials, and the most advantageous methods of projecting them are not necessarily the best for the exhibition of either films or slide sets containing the elements of developmental continuity.

It certainly is not a good idea to face the audience into the light *when such a seating arrangement can be avoided.* Such an arrangement produces a visual effect analogous to the use of bright "surround" illumination, approved by some authorities and strongly condemned by others. The author feels that surround and extraneous lighting is highly distracting. Nevertheless, when for some reason or other *the room cannot be completely darkened,* it is *absolutely necessary* to place the *regular* projection screen so that the extraneous light does not fall upon its surface.

The best plan, therefore, is to fol-

low the recommendation of the majority of visual-education experts and place the screen in one corner of the room facing away from the windows or other source of spill light. The audience is thus required to face the source of extraneous light, of course; but if the positions of screen and audience were reversed, no picture, or at most an image so faint as to be useless, would be obtained.

Advantages of Front Projection

It should be unnecessary to add that, with modern high-powered projectors, brilliant screen surfaces, and a slight reduction in the size of the projected picture, the image obtained even under fairly high ambient light levels will be comfortably bright.

The conventional reflecting-type screen permits the operator of the projector to view the picture (correcting focus and framing when necessary), offers a large projection area, and is more convenient than any other type to set up and transport. It offers the additional advantage of very low side-to-center brightness disparity—the absence of a "hot spot," to use a term borrowed from the lexicon of professional theatre projection. — ROBERT A. MITCHELL.

IA OBITUARIES

JACKSON, FRED, member of Toronto Local 173 for 38 years, died April 15. He was a member of the Canadian Pictures Pioneers, and a veteran of World Wars I and II. He was buried with full military honors in the Soldiers Plot, York Cemetery, Toronto.

• • •

KOCH, CARL B., 69, president of Local 228, Toledo, Ohio, died April 1 of a heart attack. A charter member, he and three other projectionists organized the Local 47 years ago. He held the office of financial secretary for 15 years prior to his election to the presidency in 1952. Mr. Koch was also president of Ushers and Cashiers Local B-109, Toledo. He was employed at the Paramount Theatre since 1929, when the theatre first opened.

A gold life membership card, which was in the process of preparation at the time of his death, was presented to his widow.

• • •

SUGARMAN, PHILIP, 67, member of Local 233, Providence, R. I. died recently after a short illness. Since 1926 he was chief projectionist for C & F Theatres Inc., working for many years at Fays Theatre, transferring in 1953 to the Majestic Theatre.

He was presented with a gold life membership card in the Local shortly before he was taken ill. Mr. Sugarman held membership in a number of fraternal and civic organizations and was active in labor circles. He is survived by his widow, two daughters, and a son.

IA ELECTION

LOCAL 165, HOLLYWOOD, CALIF.

George J. Flaherty, *pres.;* Albert R. Pullen, *sec.-treas.;* Leo S. Moore, *bus. rep.;* Max Lulla, *sgt.-at-arms;* Frank J. Betelli, Donald R. Hansard, C. D. Henry, *board of directors;* Donald A. Loakes, Edward Mansfield, Delmar E. Wilson, *examining board;* Richard B. Frisbie, *delegate, county AFL-CIO Federation of Labor Convention.*

McQuilkin New B & L President

WILLIAM W. MCQUILKIN has been elected president and chief executive officer of Bausch & Lomb Optical Co., succeeding Carl S. Hallauer, who was named chairman of the board. The former chairman, Carl L. Bausch, is retiring after a long and distinguished career with the company.

McQuilkin has been with B & L since 1938. He has been successively secretary, treasurer, vice-president and executive vice-president. He is chairman of the B & L subsidiary, Applied Research

Carl S. Hallauer (left), board chairman, and W. W. McQuilkin, president, of Bausch & Lomb Optical Co.

Laboratories, and also an officer or director of other subsidiaries in Canada, Great Britain and South America. He took his B. A. and M. A. degrees at Princeton University, received a Rhodes scholarship and studied at Baliol College, Oxford University, in England.

Hallauer, as chairman, will continue to be active in the company, as he has been for the past 40 years. An official of the optical industry trade association, he also serves as a director of many industrial, banking, educational and athletic organizations.

GAS AIR-CONDITIONING is one result of natural-gas industry's new research drive (American Gas Assoc.). Prototypes of three new gas-fueled, domestic air conditioning systems have been developed; a full line is due for public introduction soon. Other developments: smokeless, odorless incinerator, introduced this year; an integrated wall unit combining stove, water-heater, refrigerator, washer. dryer, furnace, air-conditioner.

SILICONE-TREATED CLOTHS

(*Continued from page* 10)

tion 19 of the Report, except that no commercial film processer would be likely to regard a random variation of average density from 0.0876 to 0.0896 as too negligible for consideration.

Use on Lenses Condemned

The use of silicone cloths to clean lenses (especially high-grade coated ones) is condemned by *all* optical manufacturers *without exception.* The effect of the silicones is chiefly a reduction of contrast similar to that produced by a very thin film of grease or a fingermark on the lens, the important point *not* mentioned in Section 21 of the Navy Report. (Certain oils of high refractive index, such as methyl salicylate, will also increase light transmission through glass, but markedly injure the image-forming performance of a lens.)

It is to be noted that Eastman Kodak warns most strongly against cleaning the coated lenses of Kodascope projectors with treated papers and cloths. In addition, most of these cloths are excessively linty, and usually become quite dirty after a period of use.

Film lubricants and conditioners should reduce the tendency of film to accummulate electrical charges. Not only are the silicones very inferior in this respect, but the friction between a silicone-treated cloth and the film nearly always induces large charges of static electricity in the film when the relative humidity of the air is not high. Very severe static marks have been noted on raw stock treated with silicones.

Film Cleaning Processes

The ability of the silicone oils and greases to promote film slippage and to protect against "sticking" in the projector gate is satisfactory. The use of a linty cloth which quickly becomes grime-embedded to "clean" film is nevertheless condemned. It is an accepted fact that the pickup of dust and dirt by napless cloths which are not kept saturated with fluid film cleaners scratches the film and often causes irreparable damage to prints. Soiled film should be cleaned and lubricated by methods which have passed the test of intensive commercial use and are approved by the industry as a whole.

The most satisfactory general commercial method of cleaning film is washing it in carbon tetrachloride or Freon-113 without buffing. Special equipment is required. The clean film is then lubricated by a light application of carnauba wax or "Hercules" P-E Tetrastearate dissolved in methyl chloroform or "Dow" Chlorothene. (An additional application of wax to the perforation margins on the emulsion side benefits prints intended for high-intensity projection.) The film may then be polished by light buffing by means of velvet buffers. This is the commercial method; and the results are infinitely superior to those obtained with fugitive, mottly, dust-attracting silicone oils and greases.

No! on Release Positives

No conceivable harm can result from the occasional cleaning of short lengths of frequently used "trailer" films in the projection room with a silicone cloth. But to use such a cloth on long reels of release positive is unthinkable. Whether used in Navy film libraries or not, silicone preparations are definitely *not used* in professional film laboratories and exchange inspection rooms.

The theatre projectionist who employs silicone-treated cloths for cleaning and lubricating release prints runs the risk of scratching long lengths of expensive film. And the projectionist who goes against the advice of *all* optical manufacturers and attempts to clean high-precision lenses with these linty, oily, treated cloths and papers is apparently looking for trouble.

"Beauty" at $2.40—75 Min.

Walt Disney's "Sleeping Beauty," now current is being sold to the public at a roadshow price of $2.40 even though it runs only 75 minutes. Some standard "A" releases getting only regular admission prices run to two and nearly three hours. "Beauty" is being coupled with a 22-minute subject titled "Grand Canyon."

INTERNATIONAL PROJECTIONIST

JUNE • 1959

VOLUME 34 • NUMBER 6

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• Screen Light Requirements in Modern Projection •

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ASHCRAFT SUPER CINEX®

THE WORLD'S MOST MODERN LIGHT PROJECTOR

A New Breathtaking Perspective of Wide Film Motion Picture Presentation can be yours.

Because it is the world's most modern projection lamp, years ahead in projection excellence for both 35 and 70mm film, the Ashcraft Super Cinex is *unlike anything that has come before or exists today.* You will have supreme satisfaction because your picture will have almost unbelievable qualities of clarity — brilliance and unmarred evenness from side to side and corner to corner.

In addition the Ashcraft Super Cinex 35/70 will bring you a history of dependability and experience: a projection reputation established over a period of more than 40 years which makes theatre owners, engineers and projectionists look upon the Ashcraft Super Cinex as the symbol of light projection excellence.

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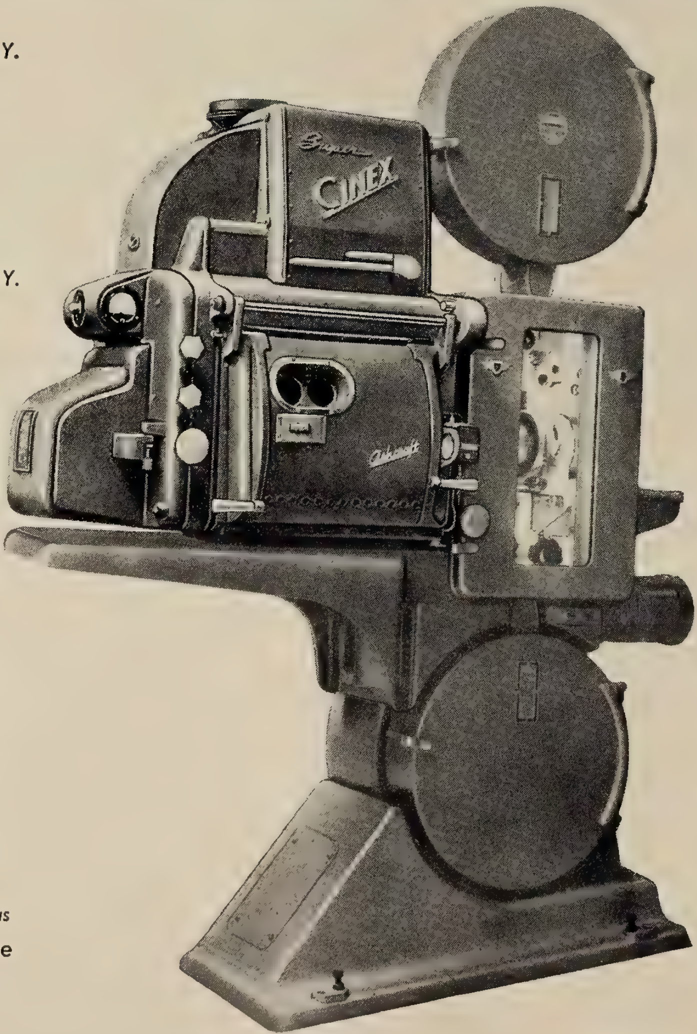
LOEW'S State — New York City, N.Y.
UPTOWN Theatre — Washington, D.C.
LOEW'S Ohio Theatre — Cleveland, Ohio
SYOSSET Theatre — New York, N.Y.
VIRGINIA Theatre — Atlantic City, N. J.
VALLEY Theatre — Cincinnati, Ohio
ROXY Theatre — Atlanta, Ga.
UPTOWN Theatre — Houston, Texas
ST. JAMES Theatre — Asbury Park, N. J.
TOWER Theatre — Dallas, Texas
STANLEY Theatre — Philadelphia, Pa.
BROADWAY Theatre — San Antonio, Texas
LOEW'S 170th Street Theatre — Miami Beach, Fla.



MGM STUDIO — Loews Inc. — Culver City, Calif.
TODD-AO Studio — Los Angeles, Calif.
PANAVISION — Los Angeles, Calif.
DRAKE Theatre — Plymouth, England
AMALGAMATED Theatres — Wellington, New Zealand
NEW MAYFAIR Theatre — Sidney, Australia
ESQUIRE Theatre — Melbourne, Australia
KUHIO Theatre — Honolulu, Hawaii
FIVE POINTS Theatre — Jacksonville, Fla.
LIBERTY Theatre — Beaumont, Texas
BRITTON Theatre — Tampa, Fla.
RITZ Theatre — Albany, N.Y.
TOWER Theatre — Corpus Christi, Texas
CAPITOL Theatre — Little Rock, Ark.
BLUE MOUSE — Seattle, Wash.
MIDTOWN Theatre — Philadelphia, Pa.
TOWER Theatre — Houston, Texas
STATE Theatre — Youngstown, Ohio

More Super Cinex lamps have been sold for 35/70 projection than all other makes combined.

Super Cinex 35/70 shown on Philips 35/70 Projector.
Super Cinex 35/70 is also adaptable to all other wide film projectors.

Initial Cost—No more, possibly less, than second or third best lamps.
Operating Cost—No more, possibly less, than ordinary 35mm lamps using 11mm carbons at 120 amps.

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JAMES J. FINN, *Editor*

R. A. MITCHELL, *Contributing Editor*

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Monthly Chat

To Insure No Action, Appoint a Committee

ONE night during May, 1937—22 years ago—there assembled in a preview projection room at Paramount Pictures headquarters in New York City a dedicated group of "projection people" who, without compensation and, in many cases, after a day's work in the projection room, considered, agreed and disagreed, and finally reached a consensus anent that which would improve the presentation of the motion picture in the theatre.

Invariably there were present such craft standouts as Harry Rubin, chairman of the Projection Practice Committee of the Society of Motion Picture Engineers; Herb Griffin, of International Projector Corp., who forgot more about projectors than most of us ever knew; Thad Barrows, a man who loved and worked at his job (without pay) as president of Local Union 182, Boston; Ben Schlanger, theatre architect; Don Hyndman, of Eastman Kodak; Allan Cook, Bausch & Lomb; Erwin Geib, National Carbon Co.; J. S. Ward, vice-president of ERPI; our own P. A. ("Better Projection Pays") McGuire, who did more for us than we shall ever be able to total; Victor Welman, then Secretary of Local 160, Cleveland, and a tireless worker for the craft, and the writer of these lines who merely collated and presented before the Society's conventions the product of far better mentalities than his.

But wait. For more than three years there was present at *every* session the then President of the Society—Dr. Alfred N. Goldsmith, whose technical accomplishments are known world-wide and who contributed lavishly of his lush technical talents to our group. The good doctor was the *first* SMPE president ever to give even passing notice to projection, much less devote his evening hours to the Committee's deliberations. As an indice, we might note here that the Doctor conceived and developed the first color-TV tube for RCA, the original model of which is now on display in his office.

Brass, only? Not at all. Two fellows from the Paramount projection room downstairs, having completed their shifts, were always present: Jesse Hopkins, the indefatigable secretary for the Committee, and Sam Glauber, who took on all and sundry when the discussion turned to projection optics.

This was TALENT to an extraordinary degree.

Perusing page 22 of IP for June, 1937—22 years ago!—we note that the Committee was not a dinner-meeting and checker-playing group but one which was considering matters such as:

ADOPTION of Projection Room Layouts as Standard; Projector Output and Screen Illumination (including means of measurements); Suprex Lamp Magnification Ratio; Motor-Starting Time, Types of Take-Up; Technical Coordination; Theatre Structures; Fire Hazards.

SCREENS: Brightness (Upper and Lower Limits); Optimal Size. The Effect Upon the Eyes of the Viewer of the Color Characteristic of the Light Source; Auditorium Lighting Conditions; Resolution of Detail and Contrast Value.

Moreover, back in 1937, there appeared as a foreword to the Committee's report the following:

AMONG THE PROJECTS considered by the Com-

(*Continued on page* 26)

INTERNATIONAL PROJECTIONIST

Volume 34 JUNE 1959 Number 6

Screen Light Requirements in Modern Projection

By ROBERT A. MITCHELL

I: Screen Illumination and the Heat Problem

EVEN THOUGH screen-brightness standards have remained unchanged (10-30 foot-lamberts), the demands made upon projection lamps by drive-in theatres and widescreen processes have become increasingly severe. For the most part, the arclamps which were powerful enough for small-screen indoor projection are now hopelessly inadequate. Not only are present-day screens bigger but *more light* must be forced through *smaller* film apertures when standard non-anamorphic prints are shown.

Specifically, the non-anamorphic widescreen aperture of 1/1.85 aspect ratio (0.446″ x 0.825″) has only 74.33% the area of the standard 1/1.375 aperture (0.600″ x 0.825″). The widescreen aperture thus passes only 0.74 to 0.80 as much light as a standard aperture, the exact amount depending on the uniformity of illumination across the aperture.

[If the utilized central zone of the "spot" thrown upon the aperture by the arclamp has a high degree of uniformity, certainly no less than about 75% of "normal" radiation gets through the widescreen aperture.]

Greater Light Requirements

Yet, because of the wider screens in use, this 75% of normal illumination must be spread out by short-focus lenses over a screen surface having 1.345 times "normal" screen area if the original picture height is maintained, as it is in most theatres. This means that we must increase the light-producing power of the arclamps by a factor of $1/0.75 \times 1.345 = 1.8$ times to obtain the same incident light (foot-candles) and the same picture brightness (foot-lamberts) which prevailed with the old format.

Apparent screen brightness may be increased with the same intensity of incident light by using directional-type screen surfaces, but we do not believe that arclamp power should be deliberately reduced just because a slightly brighter screen is going to be installed.

The anamorphic (CinemaScope) process poses a lighting problem which is different in theory but the same in practice. The CinemaScope aperture of 1/2.35 aspect ratio (0.715″ x 0.839″) passes about 1.21 times the light passed by a standard aperture. This does not mean 21% more screen lumens with CinemaScope, however, for the anamorphic attachment absorbs and wastes from 10% to 20% or more of the light, depending on which type of attachment it is. (There are three in wide use.)

Although the resultant screen-lumen value with a CinemaScope aperture *and anamorphic attachment* is ordinarily very nearly the same as the standard-aperture lumen value, the light must be spread out (at an aspect ratio of 1/2.35) over a screen area a little more than 1.7 times "normal" area. Because this factor is very close to that for 1/1.85 non-anamorphic projection (1.8), we may state as a practical rule that lamp power must be increased approximately 1.75 times to obtain with widescreen projection (any commonly used 35-mm process) the same picture brightness that prevailed with the old standard format, with the type of screen surface and its vertical dimension remaining the same.

Drive-In Screens Too Dim

This handy and easily remembered rule of "1.75 times standard-aperture lumens" is extremely important when the old conventional-screen brightness level was at a barely acceptable minimum (9 or 10 foot-lamberts). It signifies the difference between 10,000 and 17,500 lumens, or between 25,000 and 43,750 lumens.

Drive-in screens are so large (often exceeding 100 feet in width) that projection technologists have been forced to adopt for them a minimum-brightness standard of only 4 foot-lamberts. Despite this compromise with screen size, however, surveys re-

TABLE I. Lumens (*with shutter*) needed to light screens of conventional 1/1.375 aspect ratio to 10- and 4 foot-lamberts brightness.

[For widescreen of 1/1.85 ratio, multiply lumens by 0.74.]

SCREEN WIDTH IN FEET	LUMENS FOR 10 FOOTLAMBERTS		LUMENS FOR 4 FOOTLAMBERTS	
	85% SCREEN (Matte)	120% SCREEN (Semidirectional)	85% SCREEN (Matte)	120% SCREEN (Semidirectional)
10	890	620	350	250
15	1 990	1 400	800	560
20	3 500	2 500	1 400	1 000
25	5 500	3 900	2 200	1 600
30	8 000	5 600	3 200	2 200
35	10 800	7 600	4 300	3 100
40	14 000	10 000	5 700	4 000
45	17 900	12 600	7 200	5 000
50	22 000	15 600	8 900	6 200
55	26 800	18 800	10 700	7 500
60	31 900	22 400	12 700	9 000
65	37 400	26 300	15 000	10 500
70	43 400	30 500	17 400	12 200
75	49 800	35 000	19 900	14 000
80	56 600	39 800	22 700	15 900
85	63 900	45 000	25 600	18 000
90	71 700	50 400	28 700	20 200
95	*	56 200	32 000	22 500
100	*	62 300	35 400	24 900
105	*	68 600	39 000	27 500
110	*	*	42 800	30 100
115	*	*	46 800	32 900
120	*	*	51 000	35 900
125	*	*	55 300	38 900
130	*	*	59 800	42 100

veal that screen brightness is less than 3 foot-lamberts in 57% of the drive-ins checked, and is so low in some of them that low-key scenes are practically invisible!

Painfully low light levels on large drive-in screens are no longer necessary. There is no excuse for less than 4 foot-lamberts on matte screens up to 80 feet in width, on semi-directional (120% reflectivity) screens up to 95 or 100 feet in width, or on high-gain screens over 100 feet.

An 80-foot matte screen of 85% reflectivity requires for 4 foot-lamberts 22,700 lumens if of the conventional format, or 16,800 lumens if of the 1/1.85 aspect ratio. This amount of light is supplied by lamps rated at 45,000 lumens when 90° shutter blades are used, or by lamps rated at 35,000 lumens when the shutter blades have a width of 63° (5-to-1 intermittent movements.)

New Lamps Economical

Aside from the cost of the current, the economy of operation of any arc-lamp involves such factors as the price of the trims of carbons burned, their *rate* of burning, and the number of screen lumens per hour obtained per unit price of carbons. Replacement-part costs are also important in the case of lamps requiring frequent replacement of the positive-burner heads.

Judged on the basis of all these factors, the new Ashcraft, National, and Strong high-powered lamps have attained an unprecedented degree of operational economy. Some of the older lamps, particularly those of the condenser type, have become known as "dollar-eaters" and should be replaced by economical new mirror-lamps of the rotating-positive type or by "cold-mirror, blown" arcs wherever much more picture brightness is an obvious need.

The Ashcraft Super Cinex lamp, for example, costs no more to operate than many lamps burning smaller carbons at less current; and it has been known for a long time that the power requirements for the "blown" arc (Strong), adjusted for the same average brightness of source, are 15%—20% less than for the conventional arc.

The wide use of color films, which demand a snow-white projection light (a color temperature of 6000°K*), and the inception of panoramic screens have rendered the low-intensity arc so hopelessly obsolete that it no longer need be considered in the field of theatre projection. Even the lower-powered Suprex, or "simplified HI" lamps manufactured 20 or more years ago, and still used in many theatres which have since widened their screens, should be replaced by newer lamps of more efficient design.

Screens Lumens vs. Screen Width

We have seen that both 1/1.85 non-anamorphic widescreen and 1/2.35 CinemaScope require arclamps approximately 1.75 times more powerful than those used for the conventional 1/1.375 aspect ratio *when the height of the screen remains the same.* The actual number of screen lumens needed depend upon the area and reflectance of the screen surface and the brightness (foot-lamberts) we wish to have:

$$\text{Lumens} = \frac{\text{Square Feet x Foot-Lamberts}}{\text{Screen Reflectance}}$$

Table I gives the number of lumens required for the 10- and 4-foot-lambert minimum brightnesses on conventional-format screens of 0.85 (matte)

TABLE II. "Shutter Factors" for Finding Required Screen Lumens *Without* the 2-Blade Shutter Running.

The screen-lumen ratings of arclamps are measured by carbon and lamp manufacturers without film, shutter, filters, or port glass.

BLADE WIDTH	LIGHT TRANSMISSION	MULTIPLY LUMENS IN TABLE I BY:
None	100.0%	1.00
55°	69.4%	1.44
56°	68.9%	1.45
57°	68.4%	1.46
58°	67.8%	1.47
59°	67.2%	1.49
60°	66.7%	1.50
61°	66.1%	1.51
62°	65.6%	1.52
63°	65.0%	1.54
64°	64.4%	1.55
65°	63.9%	1.56
66°	63.3%	1.58
67°	62.8%	1.59
68°	62.2%	1.61
69°	61.7%	1.62
70°	61.1%	1.64
80°	55.6%	1.80
81°	55.0%	1.82
82°	54.4%	1.84
83°	53.9%	1.86
84°	53.3%	1.88
85°	52.8%	1.90
86°	52.2%	1.92
87°	51.7%	1.94
88°	51.1%	1.96
89°	50.6%	1.98
90°	50.0%	2.00
91°	49.5%	2.02
92°	49.0%	2.04
93°	48.4%	2.07
94°	47.8%	2.09
95°	47.3%	2.11
96°	46.8%	2.14
97°	46.1%	2.17
98°	45.6%	2.19
99°	45.0%	2.22
100°	44.5%	2.25
101°	44.0%	2.27
102°	43.4%	2.30
103°	42.8%	2.33
104°	42.3%	2.36
105°	41.8%	2.39

* For an understanding of color temperature, the informative article by W. W. Lozier, National Carbon Co., in IP for December 1958, pp. 10 & 11.

TABLE III. Lumen Outputs of Simplified H-I ("Suprex") Lamps.

POS.-NEG. TRIM*	ARC POWER AMPS.	VOLTS	MIRROR DIAM. (In.)	LIGHT AND HEAT WITH SILVERED MIRROR (No. heat filters) LUMENS	CENTER APERTURE ° F.
7 mm - 6 mm	40	27½	11 3/8	6,500	1200?
7 mm - 6 mm	42	36	14	8,600	1400
7 mm - 6 mm	46	38	14	10,000	1500
7 mm - 6 mm	50	40	14	11,700	1700
8 mm - 7 mm	60	37	14	13,100	1800
8 mm - 7 mm	65	39	14	14,400	1900
8 mm - 7 mm	70	40	14	15,700	2100
9 mm - 8 mm	65	40	14	13,000	1800
9 mm - 8 mm	75	43	14	15,000	2000
9 mm - 8 mm	80	45	14	16,600	2200

* "Suprex" copper-plated positives, "Orotip C" negatives (National Carbon Company)
F/1.7 coated lenses and 0.600" x 0.825" apertures used.

and 1.20 (semi-directional) reflectance, and from 10 to 130 feet in width. Now, for the lumen values needed for widescreen projection (1/1.85 ratio), the lumens given in the table should be multiplied by 0.74.

We are dealing here with identical screen widths, not heights; and when widths are the same, the wide screen, having in such a case a smaller area, needs only 3/4 the normal amount of light, on the average. CinemaScope of the *same width* needs even slightly less light, but because this varies so greatly with the type of anamorphic attachment employed, we may ignore the difference.

The special value of Table I, however, is its usefulness in estimating with a fair degree of accuracy the arclamp lumen rating needed to obtain either 10 or 4 foot-lamberts on screens of either 85% or 120% center reflectivity. We must keep in mind that output lumens are decreased to about 0.75% of normal by 1/1.85 apertures, and that carbon and lamp manufacturers, to eliminate variable factors and for the sake of uniformity, simplify matters by specifying for the different lamps and carbon trims the screen lumens obtained *without* shutter, heat filters, or port glass, and with a standard 0.600" x 0.825" aperture and $f/1.7$ coated lens.

Lumen Values for Screen Widths

All you have to do to arrive at a reasonably accurate estimate of the required lamp rating is to ignore aspect ratio in non-anamorphic projection (because lamps are less efficient with the smaller apertures) and look up under the proper heading of Table I the lumen value corresponding to the screen width being used. The lumens found are then multiplied by

TABLE IV Lumen Outputs Of Rotating-Positive Mirror Lamps.

POS.-NEG. TRIM	ARC POWER AMPS.	VOLTS	MIRROR DIAM. (In.)	LIGHT AND HEAT WITH SILVERED MIRROR: Without heat filter LUMENS	CENTER APERTURE ° F.	With dichroic filter LUMENS	CENTER APERTURE ° F.	LIGHT AND HEAT WITH "COLD" MIRROR LUMENS	CENTER APERTURE ° F.
9 mm* - 5/16"	75	52-58	16	16,000	2200	14,400	1200	16,800	1300
9 mm* - 5/16"	80	54-59	16	18,000	2400	16,200	1300	18,900	1400
9 mm* - 5/16"	85	55-60	16	19,500	2600	17,600	1400	20,500	1500
10 mm*- 11/32"	95	51-57	16	18,500	2400	16,700	1300	19,400	1400
10 mm*- 11/32"	100	54-59	16	20,700	2600	18,600	1400	21,700	1500
10 mm*- 11/32"	110	59-65	16	22,000	2700	19,800	1400+	23,100	1600
10 mm**- 7/16"	125	60-64	16	24,000	2900	21,600	1500	25,200	1700
10 mm**- 7/16"	130	62-66	16	25,000	3000	22,500	1600	26,300	1700+
10 mm**- 1/2"	135	66-70	16	26,500	3200	23,900	1700	27,800	1900
11 mm* - 3/8"	110	57-62	16	21,700	2700	19,500	1400	22,800	1600
11 mm* - 3/8"	115	58-64	16	23,100	2800	20,800	1500	24,300	1600+
11 mm* - 3/8"	120	59-68	16	24,100	2900	21,700	1500+	25,300	1700
10 mm*- 11/32"	95	51-57	18	21,700	2500	19,500	1300	22,800	1500
10 mm*- 11/32"	100	54-59	18	23,700	2700	21,300	1400	24,900	1600
10 mm*- 11/32"	110	59-65	18	25,200	2800	22,700	1500	26,500	1600+
10 mm**- 7/16"	125	60-64	18	27,500	3100	24,800	1600	28,900	1800
10 mm**- 7/16"	130	62-66	18	29,200	3200	26,300	1700	30,700	1900
10 mm**- 1/2"	135	66-70	18	30,300	3300	27,300	1700+	31,800	1900+
11 mm* - 3/8"	110	57-62	18	24,800	2800	22,300	1500	26,000	1600
11 mm* - 3/8"	115	58-64	18	26,500	3000	23,900	1600	27,800	1700
11 mm* - 3/8"	120	59-68	18	27,600	3100	24,800	1600+	29,000	1800
13.6 mm*-7/16"	125	56-60	18	20,000?	2200?	18,000?	1200?	21,000?	1300?
13.6 mm*-7/16"	135	58-62	18	24,000	2600?	21,600	1400?	25,200	1500?
13.6 mm*-7/16"	140	58-62	18	26,000	2800	23,400	1500	27,300	1600
13.6 mm*-7/16"	145	59-63	18	28,000	3000	25,200	1600	29,400	1700
13.6 mm*-1/2"	150	59-63	18	30,000	3200	27,000	1700	31,500	1900
13.6 mm*-1/2"	155	60-64	18	32,000	3400	28,800	1800	33,600	2000
13.6 mm*-1/2"	160	60-64	18	34,000	3600	30,600	1900	35,700	2100
13.6 mm*-1/2"	165	62-66	18	35,500	3700	32,000	2000	37,300	2200

* Regular unplated (black) H-I positives. ** "Hitex" positives. All negatives "Orotip". The 7/16" "Orotip Special" may in certain cases be substituted for 1/2" regular "Orotip" negative. F/1.7 coated lenses and 0.600" x 0.825" apertures used in all light measurements. (Aforementioned carbons by National Carbon Co.)

TABLE V. Lumen Outputs of Condenser-Type Lamps.

POS.-NEG. TRIM	ARC POWER AMPS.	VOLTS	CONDENSER "SPEED"	LIGHT AND HEAT OUTPUT			
				Without heat fltr.		With dichroic fltr.	
				LUMENS	CENTER APERTURE ° F.	LUMENS	CENTER APERTURE ° F.
13.6 mm*- 7/16"	125	68	f/2.0	15,000	2100	13,500	1100?
13.6 mm* - 1/2"	150	74	f/2.0	19,500	2700	17,600	1400?
13.6 mm* - 1/2"	160	77	f/2.0	20,500	2900	18,500	1500?
13.6 mm**-½"***	170	70	f/2.0	20,700	3000	18,600	1600?
13.6 mm**-½"***	180	74	f/2.0	24,800	3300	22,300	1700?

* Regular unplated high-intensity projector positives. ** "Hitex" positives. *** "Orotip Heavy Duty" negatives. All other negatives regular "Orotip". (All carbons by National Carbon Co.)
F/1.7 coated lenses and 0.600" x 0.825" apertures used.

the shutter factor corresponding to the angular width of the shutter blades used. The shutter factor is 2 for 90° blades; others may be found in Table II (2-blade shutters only).

Lamp lumen rating = Lumens in Table I x Shutter Factor in Table II.

To save you the trouble of further multiplications, the lamp-lumen tables (Tables III-VI) give the lumen ratings with silvered mirrors alone, silvered mirrors with heat filters, and the new "cold" mirrors.

As an illustration, suppose a medium-size drive-in has a mildly directional screen 60 feet in width (low-gain aluminum of 1.2 center gain). How many lumens are needed for 4 foot-lamberts of brightness? What lamp rating is required if 90° shutters are used on the projectors? Which specific lamps, carbon trims, and currents are suitable?

Table I gives 9000 lumens as the value for 4 foot-lamberts on a 60-foot 120% screen. Lamp rating required = 9000 x 2 (shutter factor found in Table II) = 18,000 rated lumens. Consult Tables IV and V for lamps and trims giving 18,000-19,000 lumens.

The most powerful lamps available (Table VI) are rated at 46,000 lumens at their highest current and with Ultrex carbons. These lamps are capable of furnishing 10 foot-lamberts on a 60-foot screen of 120% reflectivity!

Lumen Ratings of Arcs

The actual number of screen lumens obtained from any lamp depends upon such factors as mirror reflectance and heat-filter transmittance as well as upon such mechanism characteristics as shutter efficiency, aperture transmission, and the optical speed of the lens. As stated previously, to simplify matters the screen-lumen tables published by the manufacturers of lamps and carbons are based upon the values obtained with standard apertures and *f*/1.7-1.8 coated lenses, and without shutter, heat filters, or port glass.

Tables III-VI, presented herewith, are based in the main on the averaged data published by National Carbon Co.,** but in addition to the lumen values obtained with silvered glass reflectors, the values with heat filters (dichroic, or interference-type) and with "cold" mirrors are listed. The lumen values for mirror lamps burning 13.6-mm carbons (Table IV) were obtained from independent sources, and the blown-arc data in Table VI were supplied by Strong Electric Corp.

The Perennial Heat Problem

The center-aperture temperatures for all lamps and carbon trims are given in the tables in Fahrenheit degrees, and were obtained from the radiant-energy flux data furnished by a number of sources.

(Note that aperture heat cannot be correlated with the lumen values, as the heat at the center of the aperture depends upon positive-crater factors, distribution of the radiant flux, and the type of mirror or condensing lenses.) The temperature data for 13.6-mm mirror lamps and for "blown" arclamps are somewhat uncertain.***

Radiant heat absorbed by the film is a problem that has become increasingly serious as the power of arclamps has increased. Fortunately, such new developments as effective infrared-absorbing heat filters and "cold" mirrors have more than counteracted the effects of radiant heat on the film. These devices, together with water-cooled gates, have done very much to minimize film buckling and print damage.

The relative heat-reducing efficiencies of the various types of mirrors and heat filters are worth careful consideration. The glass mirror having a coating of silver on its rear surface has been a standard item for many years; and the radiation reflected from such a mirror includes 90% of the light (visible radiation) falling upon it together with much of the invisible infrared emitted by the HI carbon arc.

Bolometric measurement reveals that about half of the heat generated

(*Continued on page* 24)

** National Projector Carbon Bulletin No. 4.

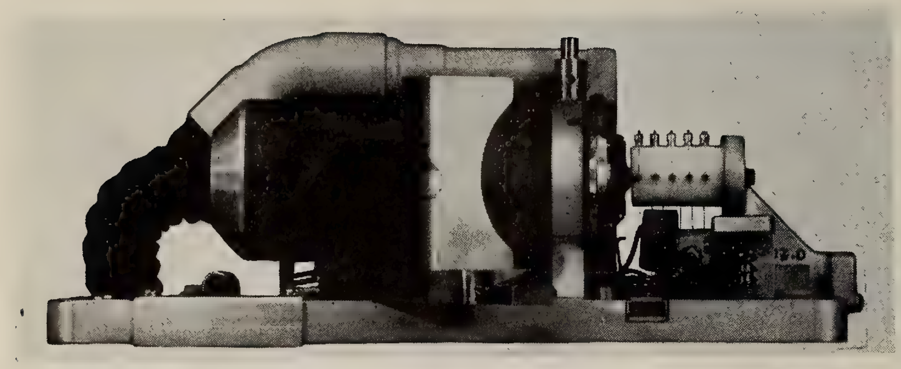
*** To convert to watts per sq. mm, divide the Fahrenheit temperature by 3000.

TABLE VI. Lumen Outputs of "Blown"-Arc, Cold-Mirror Lamps.

POS.-NEG. TRIM	ARC POWER AMPS.	VOLTS	MIRROR DIAM. (In.)	LIGHT AND ESTIMATED HEAT WITH COLD MIRROR (No heat fltr needed)	
				LUMENS	CENTER APERTURE ° F.
10 mm** - 7/16"*	130	71	21	36,400	1900?
10 mm** - 7/16"*	138	76	21	41,000	2100?
10 mm***- 7/16"*	155	74	21	45,000	2300?
10 mm***- 7/16"*	160	76	21	46,000	2300+?

* Solid graphite-rod negative. ** "Hitex" positive. *** "Ultrex" positive. (Carbons by National Carbon Co.)
Screen-light side-to-center distribution 80%. F/1.7—1.8 lenses and 0.600" x 0.825" apertures.


DOUBLE SPEED:
BETTER COLOR BALANCE!
APRIL, 1959: Kodak makes history with a new 35mm Eastman Color Negative Film. Not only is this new commercial negative *twice as fast*, but, it has better color balance and—*the same fine grain!*
Thus, Kodak again lives up to its promise . . . Motion picture films for every purpose. Branches at strategic centers. For technical details, inquire . . .
Motion Picture Film Department
EASTMAN KODAK COMPANY, Rochester 4, N. Y.
East Coast Division
342 Madison Avenue
New York 17, N. Y.
Midwest Division
130 East Randolph Drive
Chicago 1, Ill.
West Coast Division
6706 Santa Monica Blvd.
Hollywood 38, Calif.
or W. J. German, Inc., Agents for the sale and distribution of Eastman Professional Motion Picture Film, Fort Lee, N.J.; Chicago, Ill.; Hollywood, Calif.



Ampex video head assembly with the concave guide swung away from the head drum.

THE VIDEOTAPE* RECORDER

By GEORGE B. GOODALL
Ampex Corporation

This is the third in a series of articles describing the Ampex Videotape Recorder. It discusses the basic theory of recording video on tape, and shows how conventional magnetic recording principles were adapted to this new process.

III. BASIC PRINCIPLES OF VIDEOTAPE RECORDING

IN the preceding articles of this series we examined the fundamental principles of magnetic recording and some of the more important factors relating to frequency response. With this foundation, we will now see how these principles were adapted to record the video signal.

Perhaps it would be best to start by investigating the problems involved in recording picture information. The television signal contains components which approach d-c at the low end and extend to over four megacycles per second at the high end. The main concern of Ampex engineers in developing the Videotape Recorder was how to record this entire frequency range and still maintain adequate playing time. Now, let's examine this a little further.

UPPER FREQUENCY LIMIT AND TAPE SPEED

As previously indicated, the high-frequency limit in magnetic tape recording is basically determined by the relationship of the recorded wavelength of the signal on the tape and the dimension of the reproduce head gap (disregarding head resonance for the moment). As the upper frequency requirement is extended, either the head gap must be reduced in size or the record/reproduce tape speed must be increased to spread the signal over a greater length of tape.

A magnetic recorder for audio applications, operating at a 7.5 inch per second tape speed, will record a 15 kc signal at a rate of 2 kc for each inch of tape. Thus the recorded wavelength of that signal on the tape will be 0.5 mil (or 0.0005 inch). Achieving this same recorded wavelength for a four-megacycle signal would require a tape speed of 2000 inches per second —which works out to be 10,000 feet per minute or over 113 miles per hour!

Of course, this assumes the use of a standard audio head, which is a rather impractical assumption. However, the use of the most precise heads —assembled under laboratory conditions and incapable of being produced in quantity—still would require a tape speed of 200 inches per second. It is interesting to note that 60,000 feet of tape on a reel 38 inches in diameter would be necessary to provide a one-hour program at this absolute minimum speed. Our tape transport would have to be built like a Diesel truck!

Thus the problems of high-frequency response and adequate playing time were seemingly not compatible. Many early experiments (not conducted at Ampex) had as their goal multi-channel time multiplex or frequency-multiplex devices, in which the frequency response requirement would be approximately divided by the number of channels provided. These experiments, however, have never resulted in a practical equipment.

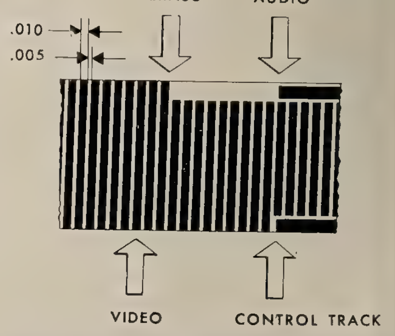
Bandwidth Requirements

We have already seen that the low-frequency response rises octave-for-octave with the high-frequency requirement, and that approximately 10 octaves is the most that can be successfully recorded and reproduced on magnetic tape. For example, the normal frequency response in conventional audio work is from 30 to 15,000 cycles; if we double the high-frequency requirement we must expect the low-frequency limit to double. This is simply a matter of decreasing head output, as the recorded wavelength gets longer and longer, reaching the point where the signal-to-noise ratio is intolerable.

The bandwidth of the video signal is approximately 18 octaves, so here was the third basic problem.

THE VIDEOTAPE RECORDER

The most important factor in solving the problems associated with video recording was the idea of mounting the heads on a rotating drum and moving them across the tape, rather than using the conventional means of moving the tape past the heads. This method provides high head-to-tape velocity and still maintains a low reel-to-reel tape speed, which must only



A completely recorded tape has three separate channels of information—the video tracks, the audio track, and the control track.

* Trademark, Ampex Corporation.

provide proper separation for the recorded transverse tracks. Recording and reproducing are performed by the same heads.

Four heads are mounted at 90-degree intervals on the periphery of a drum two inches in diameter which is directly driven by a 14,400 rpm electric motor. This provides a head-to-tape velocity of approximately 1500 inches per second across the two-inch wide magnetic tape. Such high velocity has resulted in the ability to produce video heads in quantity lots—although they still must be much more precise than standard audio heads.

As each head moves across the tape it records a track 10 mils (0.010 inch) wide, and a separation of 5 mils between each recorded track is necessary. In conjunction with the rotational speed of the head drum, a reel-to-reel tape speed of 15 inches per second supplies proper track separation, and provides 64 minutes of playing time from a reel of thin base tape 12½ inches in diameter.

The rotating head approach requires that the tape be cupped around the arc descried by the heads. This is accomplished by employing a concave tape guide, *precisely machined to mate with the head drum.* A vacuum is applied at the guide side of the tape to ensure that the tape assumes a position which conforms with the shape of the guide. The distance of the guide from the head assembly can be adjusted by a manual control or by automatic means.

A frequency-modulating/demodulating process is employed to effectively compress the wide bandwidth of the television signal. If we consider that the frequency components of that signal be in the range from 10 cycles to 4 megacycles, we have an impossible 18 octaves to record. However, if that signal is used to frequency-modulate a carrier in such a manner that the original intelligence is contained in a sideband spectrum from 750 kc to 7 megacycles, we have reduced our requirement to less than 4 octaves and are easily within our magnetic recording limitation.

So, the three primary difficulties in recording the video signal were overcome by the use of rotating heads and a modulation system.

Before one video head *loses* contact with the tape, the *succeeding* head has made contact. There will be therefore identical information recorded at the *bottom* of one track and the *top* of the next track. Subsequent recording of the audio and control channels destroys some of this duplicate information, but enough is retained so that electronic switching from head to head can be accomplished during an "overlap" period in the reproduce mode.

Recording the audio signal is now accomplished by conventional magnetic recording techniques discussed in the previous articles. When the tape moves past the video head assembly, parallel tracks of video information are recorded across its entire width, with duplicate information at the *top* and *bottom* of adjacent tracks.

A normal erase head clears a track on the upper edge of the tape—erasing part of the redundant video. The audio signal is conventionally amplified and mixed with a bias voltage, then delivered to a standard audio head which records the signal longitudinally on the erased portion of the tape.

In all respects the audio portion is handled identically as it would be in a conventional audio recorder operating at the familiar 15-inch-per-second tape speed. The heads are stationary and record longitudinally on the tape, just as though it were a single-channel recorder using narrow tape. The *audio* lags *video* by 9¼ inches of tape, or 0.62 second.

So we now have audio and video information recorded on the tape. *But* the rotating-head approach which solved our basic problems has created other difficulties which must be overcome before we have a working machine. For instance, tape motion from reel-to-reel must be locked to the rotation of the head drum to ensure that the video heads will pass directly over previously recorded tracks during the reproduce mode. The video head drum must rotate at an unvarying speed with minimum "hunting," and phase correction must be provided for the head drum motor.

During the reproduce mode we must electronically choose a head contacting the tape to provide the playback signal, and do this switching at a time when it will not be visible in the TV picture. And finally we must be sure that our recording/reproducing process has not resulted in deformation of the synchronizing pulses in the composite video signal.

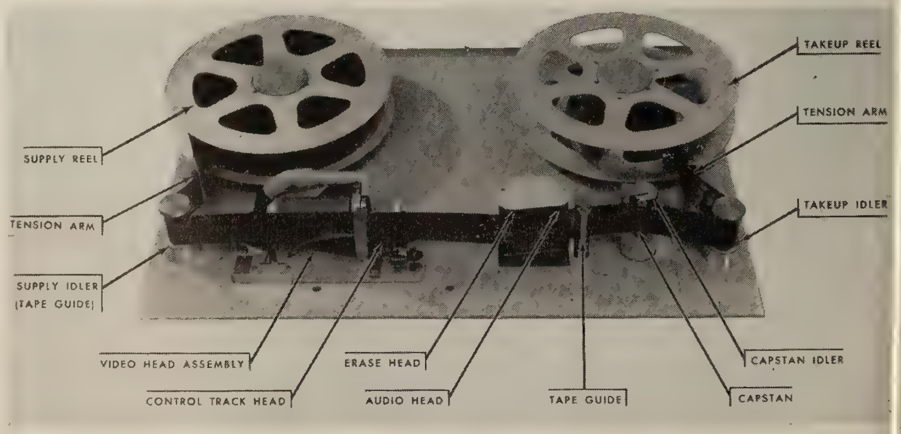
These problems necessitated the addition of certain electronic servo, switching, and processing circuits.

[The function of a "servo mechanism" is explained in a separate item accompanying this article.]

Before discussing these circuits, let's take a quick look at the composite television signal. In the United States the picture we see is made up of 525 lines of horizontal information, with each line scanning from left to right. There are 30 "frames" per second composed of two fields, with the horizontal lines placed one under the other to form the "raster." There is actually an interlace of horizontal lines here, with all odd-numbered lines and all even-numbered lines laid down in separate "fields". Therefore, at the end of each horizontal line we must return the electron beam from the right side to the left side, and we must blank the picture tube during this "horizontal retrace" time.

The same holds true for vertical movement: at the end of each field we must return the electron beam from

(*Continued on page* 22)



Note how the Videotape recorder tape transport resembles the conventional audio transport. Note also the relationship in the position of the video, control track, erase, and record heads

New Strong Electric Corp. 35/70-mm Arclamp

Looking toward the future, the Development Section of Strong Electric Corp. has supplied IP with the appended details of its new 35/70 arclamp which was specifically designed to accommodate both the standard 35-mm and the anticipated 70-mm feature film releases.

THE recent introduction of several new 70-mm projectors presented a number of complications which had to be resolved in the design of the new Strong "35/70 Special" arclamp. Heretofore, the distance between the film line and the rear of the projector has been fairly standardized in 35-mm projectors, but different dimensional requirements are encountered in many of the 35/70 units.

The "35/70 Special," accordingly, had to be designed with an optical system which matched the requirements of all these 35/70 projectors, including the Century, National 70, Victoria X, modified Simplex XL, and Philips. Result: an optical system accommodating a film line to rear of projector distance of from 5 to 9 inches.

Prime requisite of an arclamp for 70-mm projection is that it projects a spot which *completely* covers an aperture more than twice the width of that common to 35-mm projection. Additionally, since higher quality is inherent with and expected of 70-mm, the aperture must be covered more *uniformly* than usual with the narrower-gauge film.

Carbon Size Selection

These two factors, while demanding a new optical system, narrow down the choice of elements employed. An example of this restriction is the size of the carbon selected.

With a reflector of practical magnification of from 5-7 to 1, only the 13.6-mm positive, burned at from 120 to 130 amperes, affords peak efficiency together with efficient screen uniformity. Incidentally, this carbon probably would have been selected even though greater latitude of size were possible, since the larger crater and greater brilliancy precisely met the demands for full aperture coverage and uniform distribution.

Strong's new 35/70 Special arclamp.

Notably, an 18-inch diameter Strong Tufcold reflector is employed. Resultant heat at the aperture is so low as to permit projection of the wider print without film damage or buckling, which impairs focus. The greater expanse of screen to be covered and the photographic quality of 70-mm prints dictates that a screen light constant in color temperature be obtained if good picture rendition is to be achieved. Accordingly, the Strong Lightronic automatic arc crater positioner has been integrated in this lamp as standard equipment at no extra cost.

Arc Crater Positioning

The Strong arc crater-positioning system enables the "35/70 Special" to maintain a screen light of constant intensity and color *automatically*. The carbons are advanced by means of separate feed motors as the carbons are consumed, to maintain a uniform arc gap length and to position the positive arc crater at the exact focal point of the reflector. A single adjustment controls *both* carbon feeds.

Long experience has enabled simplifying the air-cooled carbon contacts; a water circulator or special plumbing is not required.

This reflector-type, 70-mm projection arc accommodates a full 20-inch positive trim of carbon which, burned at 125-130 amperes, permits more than 120 minutes projection time, amounting to as much as an extra full double reel from a single positive carbon.

Original, Operating Cost

This projection arc is a compatible equipment, since it can be used as efficiently with 35-mm film as with 70-mm film. Without change of reflector, the lamp may be switched from 35- to 70-mm and back, with only a few seconds adjustment. Since the automatic crater-positioning system maintains the positive crater at a predetermined distance from the positive contact assembly for most effective carbon burning, it requires only the turn of a single knob, thus moving the entire arc-burning assembly in relation to the reflector focal point to make the change from 35 to 70 or 70 to 35 projection.

This special arc is priced comparable with that of 90- to 135-ampere lamps. This lamp can now improve considerably 35-mm projection and still be ready to move to 70-mm, regardless of the make of projector.

The 13.6-mm carbon, because of its large crater, can be operated at a very low-cost burning rate, while maintaining high screen brightness. Were it possible to employ a smaller carbon with greater magnification for 70-mm projection, the carbon-burning rate and operating cost would be considerably higher. As designed, the cost of operating the "35/70 Special" is not higher than that of many 35-mm lamps.

Low current of 120-130 amperes, and the attendant low arc voltage of 58 to 63 volts, will ordinarily effect further saving for the theatre equipping for 70-mm presentation in that in many cases presently-installed rectifier or motor-generator equipment, as well as wiring, may be used with this lamp.

William P. White is Named Strong Elec. Field Man

The appointment of William P. White as national traveling field representative has been announced by Arthur Hatch, president of The Strong Electric Corp., Toledo, manufacturers of motion picture projection arc lamps, graphic arts equipment, spotlights, and slide projectors. Mr. White is moving his family to Toledo from Charlotte, North Carolina, where he has been operating the Southeastern Theatre Equipment Co. He has been identified with theatre equipment throughout his business life, and has managed the National Theatre Supply and Wil-Kin Co. branches in Charlotte.

William P. White, new Strong Electric field representative.

Wonders Never Cease

HIGH-SPEED MOVIES have been used as dust-control tool. Locating leaks in dust-control systems often is difficult with standard air-sampling methods. Also, designing control systems is difficult without knowing exact sources and pattern of dust. High-speed movies (500 to 3,000 frames a second) show where dust originates, where it goes, and shape of dust clouds.

Viewing the Projector as an Integral Optical-Mechanical System

By HAROLD E. ROSENBERGER

Bausch & Lomb Optical Company, Rochester, N. Y.

The concluding installment in a series of articles which, considering the components of the arclamp-projector-optical train, present a persuasive argument in favor of a completely integrated unit in design and manufacture.

BY FURTHER increase in condenser magnification, accompanied by the required increase in condenser diameter, we can increase the size of the image of the source until it compltely covers the film gate.

As we have seen, this illumination system will provide the same amount of light to the projection lens from the center of the gate as the projection lens would have received had we physically located the arc at the center of the gate. Although we have completely covered the gate with the arc image, this last statement will generally not be true for the *outer* regions of the gate even though each point in the gate receives the same amount of energy as the center. The reason for this is shown in Fig. 3D.

If the projection lens is to receive the same amount of light from a point at the *edge* of the gate as it receives from a point at the *center*, the $f/2$ cone shown in the figure will have to be filled with light. But it will be noted that only the hatched portion of this cone can receive light from the condenser.

It will also be noted that the bottom portion of the cone leaving the condenser misses the projection lens, so that while the film gate may be illuminated uniformly (within the limits of arc uniformity and the cosine effect) the image of the film gate formed on the screen by the projection lens will not be uniformly bright from point to point.

Condenser Speed Paradox

Figure 3D shows the paradoxial situation, with which we must contend, of the condenser being simultaneously both too fast and too slow for the projection lens.

The condenser is too fast because the energy contained in the bottom of the cone leaving the condenser reaches the film with a consequent heating of the film, but serves no useful purpose since the light in this portion of the cone never reaches the screen. The condenser is too slow because it does not fill with light the bottom portion of the cone in front of the projection lens.

We can increase the condenser speed beyond what we need to fill the projection lens on axis and thereby increase the amount of useful light the projection lens receives from the edge of the gate, but this gain in screen illumination will be accompanied by a much greater gain in the total amount of radiant energy incident on the film.

Two further complicating factors in this problem of choosing the best condenser speed for a given speed projection lens are, first, the vignetting which occurs within the projection lens; and second, the effects of increased aberrations in the condenser as its speed is increased. Furthermore, there is the added problem of increased bulk in the lamphouse.

The foregoing discussion applies equally well to both refracting (lens) and reflecting condenser systems and we have used the lens system for ease of illustration. Since the reflecting system is in predominant use in 35-mm projection, we shall close our discussion with two remarks concerning these reflecting systems.

Computing f/Number

The first concerns the method of computing the f/number of the reflector. Fig. 4 is a sketch of a reflector which is in actual use today. The true speed of this reflector is obtained by dividing the hypotenuse of the triangle by the free aperture of the reflector, which turns out to be $f/1.8$.

From time to time published articles appear which indicate that the f/number is obtained by dividing the axial distance between the face of the reflector and the film gate by the free aperture. By this latter method the reflector would appear to be $f/1.73$.

"Cold" Mirror Characteristics

This point is brought out for the benefit of those who might have occasion to construct a system in which the speed of the reflector is exactly equal to that of the projection lens. If the reflector speed is computed by

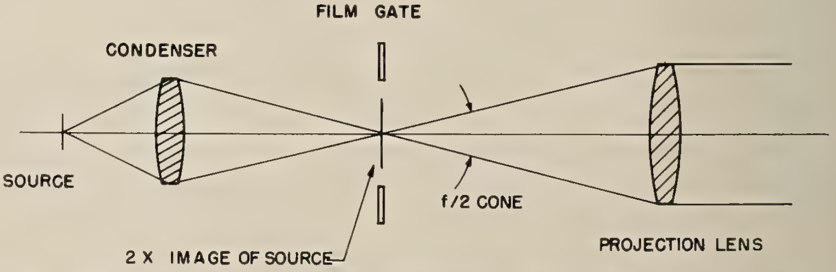


Fig. 3C. Illumination system: condenser magnification increased to 2X, doubles the size of the source image.

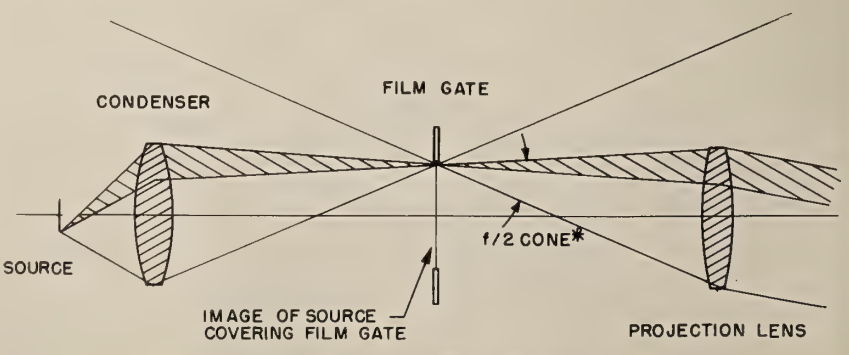


Fig. 3D. Optical illumination system.

the latter method, it will be too slow for the projection lens.

The final point of discussion concerns the recently introduced "cold" mirror. The cold mirror differs from the old-style silvered reflector only in the material used for its reflecting surface and the manner in which the material is applied. Instead of silvering, a series of thin non-metallic films is evaporated onto the convex surface of the reflector blank. By carefully controlling the material, film thickness and sequence of these films, a highly selective reflecting surface is built up.

The result is that in the visible region of the spectrum the reflectivity of this filmed surface is not less than 90% that of a silvered surface, while the total radiant energy incident on the film gate is reduced by not less than 35%. This means that for the same amount of screen illumination the film gate operates at a substanially lower temperature.

Requisite Modifications

An alternative is to increase arc current to gain greater screen illumination without increasing film-gate temperature. This latter choice requires some modification in the lamphouse. The cold mirror currently on the market was designed to operate in conjunction with an arc drawing 90 to 120 amps. When the cold mirror is used with arcs drawing greater than 120 amps, reflector cooling must be provided. Without additional cooling, the reflector life is severely reduced.

Having considered each of the individual components of the projection optical system in some detail, it will be of interest to have a look at all of these components in combination. Figure 5 is a true scale drawing of a complete present-day projection optical system.

[CONCLUSION]

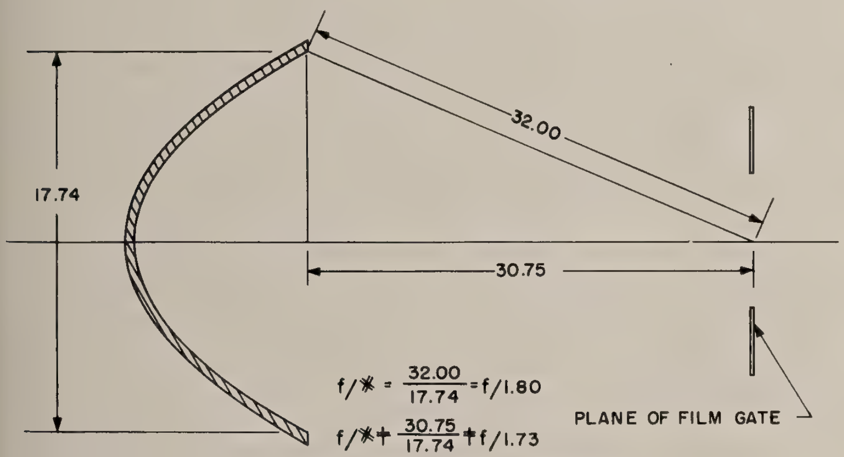


Fig. 4. Reflector f/number determination.

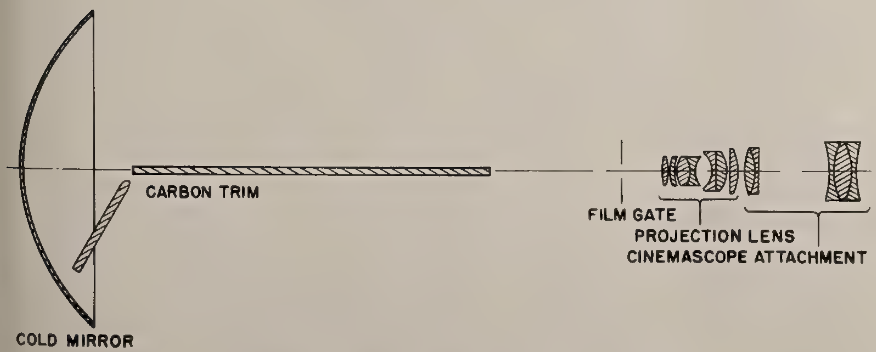


Fig. 5. Optical system for 35mm professional projection.

National Carbon's Color-Sound Film on the Arc

IN THE first of a series of showings scheduled for throughout the country, J. W. (Bill) Cosby, arc carbon sales manager for National Carbon Co., screened for the recent "Show-A-Rama" audience in Kansas City, Mo., the 15-minute sound picture "Carbon Arc Projection," in resplendent Technicolor, which demonstrates the optics of motion picture projection and the unique role played by the carbon arc in the broad science of light, sight, and color.

The film is divided about equally between live action and animation, with one sequence of the latter presenting a diagrammatic description of projection optical systems which harness the tremendous intensity of light necessary for motion picture screens, especially the huge expanses used in drive-ins.

J. W. Cosby, carbon arc sales manager for National Carbon Co.

Precise Instruments Shown

Other sections of the picture show the actual operation of scientific equipment used to measure the crater brilliance of the carbon arc, and give a graphical explanation of how closely the light from a high-intensity carbon arc approximates natural sunlight. Also included is a demonstration of how a motion picture film acts as a filter to reproduce on the screen the colors that are possible *only* if those colors are in the light source used. The audience learned that only adequate light on a screen can overcome the shutter action that actually makes a movie screen dark nearly half of the time.

Mr. Cosby's talk also made use of a series of colored slides selected from illustrations in NCC's Projector Carbon Bulletins. This material, easy to understand even for non-technical personnel, was taken from Bulletins 3, 4, and 5 dealing with Screen Light Checking Procedures (light source and optical systems), and Operating Procedures.

Showings of this film before groups of projectionists in a given area may be arranged through any one of NCC's 12 trained arc carbon representatives throughout the country, who are available at any time for consultation on projection problems.

ELECTRONIC EQUIPMENT ten times smaller than any made to date can be built with tiny Fotoceram glass-ceramic wafers, says developer, Corning Glass Works. Wafers serve as resistors, transistors, capacitors, and diode bases in new micro-module circuit assemblies. Wafers are one-third inch square; can be made in thicknesses as small as 0.010 in. Since wafers are produced by photo-etching process, design changes are made by *change in art work* rather than by elaborate tooling.

The Light Outputs of 16-mm Projectors

THERE are definite signs that the motion-picture screens in schools, like theatre screens, are being increased in size for better picture visibility. This is particularly true of the screens used in school auditoriums and assembly halls.

The 16-mm projectors produced many years ago had relatively low lumen ratings, or light outputs, and are manifestly unsuited to big-screen showings. Modern projectors have "fast" optical systems, coated lenses, and more powerful light sources. The carbon arc, long reserved for professional 35-mm projection, is now available for school, church, and organizational use. Even so, the light outputs of the currently available 16-mm projectors vary widely.

Illumination Efficiency Factors

The differences in illumination efficiency among different projectors using the same size of bulb may be attributed to three separate factors: (1) optical speed and light transmission of the projection lens; (2) per-cent transmission of the revolving shutter, and (3) design and efficiency of the light-condensing lenses and mirrors.

Taking 100% as the transmission efficiency of F:1.6 coated lenses, other "speeds" of coated 16-mm projector lenses have the following efficiencies:

Lens Speed	Relative Efficiency
f/1.6	100%
f/1.8	79%
f/2.0	64%
f/2.4	45%
f/2.5	41%
f/2.8	33%

The transmission efficiency of the projector shutter depends upon the pull-down ratio of the intermittent movement. Because most 16-mm projectors have 5:1 claw movements, 65-degree shutter blades are employed. These have a light transmission of 64% in the case of 2-blade shutters, or 1-blade shutters revolving twice for each cycle of the film pull-down claw. This value is arbitrarily set at "100% efficiency" in the following tabulation of shutter efficiencies:

TWO-BLADE SHUTTERS

Blade Width	Light Transmission	Relative Efficiency
95°	47%	73%
90°	50%	78%
65°	64%	100%
60°	67%	104%
45°	75%	117%

THREE-BLADE SHUTTERS

Blade Width	Light Transmission	Relative Efficiency
65°	46%	72%
60°	50%	78%
45°	62%	97%

Light Measurements Important

Condenser-system efficiency varies enormously, but is not easily specified without making light measurements on *all* the different models of *all* the different makes of projector. Some of the newer projectors supply fully twice as much light to the film *with the same bulb wattage* as mechanisms made only a few years ago.

The following table gives the *approximate* average number of lumens of projection light provided by 16-mm projectors having shutters of 64% transmission and F:1.6 and F:2.0 coated lenses. These measurements were made with the projectors running, but with no film in them.

Luminous Output of an "Average" 16-mm Projector With Different Combinations of Lamps and Lenses

POWER OF PROJECTOR LAMP	APPROXIMATE LIGHT OUTPUT IN LUMENS		WIDTH OF PICTURE ON A MATTE SCREEN OF 80% REFLECTIVITY FOR 10 FOOTLAMBERTS	
	f/1.6	f/2.0	f/1.6	f/2.0
300-W Bulb	80	50	3'	2½'
500-W Bulb	150	100	4'	3½'
750-W Bulb	230	150	5'	4'
1000-W Bulb	300	190	6'	4½'
1200-W Bulb	370?	240?	6½	5'
10-A LI Arc	750	480	9'	7'
30-A HI Arc	1600	1000	13'	10'
46-A HI Arc	2400?	1500?	17'	13'

* * *

NAV's 5th A-V Directory a "Must" For The Field

COMPREHENSIVE, exact and most legibly presented are the data given in the Fifth Edition of "The Audio-Visual Equipment Directory," published by the National Audio-Visual Assoc., Inc., at Fairfax, Virginia. Handsomely bound, spiral, and printed-pointer indexed, this directory is a "must" for all workers in the A-V field.

Through all of its 242 pages this directory gives precisely the type of data which A-V people need—and at a moment's notice. Although printed in offset, we have never seen a compendium of technical data which delivers information with such clarity. One need not wade through innumerable pages of illustration and copy to find the particular piece of equipment or application which is of pressing interest: it is all at one's fingertips.

Priced at $4.75, this volume is really priceless for A-V workers. It not only tells what but also why and where.

* * *

How Not to do It!

I was called into consultation recently by a church which had booked a 16-mm CinemaScope print. The anamorphic sent to them arrived with a mounting bracket—and not one word of instruction! There is sure to be more of this.

Trick Titles Without Special Equipment

The 16-mm motion-picture camera is finding increasing use these days in schools to provide a permanent pictorial record in lifelike motion of field trips, student projects, and special class events. The 16-mm film size is preferred because it can be shown with the school's high-grade projectors.

School-made films should be provided with titles; and even when the films have subsequently been magnetically striped for recorded commentary, a main subject-title should be affixed to each reel. Neatly-lettered titles in black-and-white or color may be photographed with the regular 16-mm camera if the lens is carefully focused, or a close-up attachment used. Inexpensive title-making outfits are also easily obtained.

Make Titles Overly Long

It is better to film too great a length for a title than not enough, for footage may be excised from an overly long title. As a rule, allow one second per word in the title (24 frames at sound speed, 16 at silent). Main titles, on the other hand, should be longer, for there is always the chance that they may become torn, and thereby shortened, by careless threading of the projector.

Professional-looking "effect titles" having white letters superposed over a background scene in motion can be made without special equipment and without the need for expensive laboratory superpositions from separate films. Here is the general procedure:

Photograph a definite number of feet of a black title card printed in white letters. Give full exposure with photofloods or sunlight. Cap the camera lens and wind all the film footage back to the starting point so that it may be exposed again. (If the camera does not run in reverse, it will be necessary to wind the film back *by hand* in *total* darkness.)

Now take the camera out-of-doors to photograph the desired background. **Underexpose this shot by stopping down the lens about three openings smaller than the recommended setting for the type of film employed.** If this is not done, the white letters of the title will be lost in the glare of the highlights in the background scene.

Special Camera "Tricks"

Special cinematic trickery adds to the excitement of homemade "supered" titles. A background shot photographed from the front of a speeding locomotive might be ideal for a field-trip main title —if you can get permission for a ride in the engineer's cab or on the cowcatcher.

To produce such a title, photograph the title card as suggested, *but with the camera upside-down*. On your next train ride, obtain a seat on the observation platform of the rear car. Photograph the *receding* scenery along the tracks, but with the camera *again* held upside-down.

When the film comes back from the processor's, cut out the upside-down title, turn it end-for-end and splice it to the opening scene of the reel for which it was made. The effect will be startling—even to those who may suspect that the camera doesn't always tell the truth!

Further professional elaborations may include fade-ins and fade-outs of the title letters, or even "dissolves" if a count be kept of the footage exposed and wound back at each stage. The background scenery may be exposed first, if convenient; and it is suggested that more footage than is absolutely necessary be expended upon it. The excess footage is easily snipped out and discarded when the finished film comes back from the processing station.

Teaching With "Uncompleted" Projectables

THE BLACKBOARD with its chalk crayons and felt erasers is the oldest of visual teaching aids, and still the most widely used. Modern variants of the old-fashioned blackboard are of special interest because they may be combined with the slide or opaque projector to form a "teaching team" of remarkable effectiveness in certain areas.

The modern "blackboard" is not necessarily black, nor is the "chalk" used for writing upon it necessarily white. A wide variety of white, pale green, and other light-colored *chalkboards* are employed in the classrooms of today. Now, the white chalkboard can be used as a projection screen for a special purpose.

Obviously, there are right and wrong ways of constructing sentences, of declining German nouns or conjugating French verbs. Thought and knowledge are required to draw rivers on a map from which they are missing, to complete an unfinished problem in arithmetic, or to label correctly the parts of a flower, a paramecium, or a Diesel engine.

The Missing Link

Slides or opaques for such exercises (which have all the elements of an entertaining puzzle) must be prepared beforehand by the teacher for his own courses. These, for the most part, will be line drawings, black on a white ground. They will be simple, accurately drawn diagrams which are noteworthy in one respect: *they are incomplete.*

Everything that is revealed is correct, but important details are lacking, e.g., a map of Europe without the chief cities, a Latin sentence without word-endings, a diagram of a partially wired radio receiver, a lab setup of a contact-process sulfuric-acid plant with none of the flasks and ignition tubes connected, etc., etc. The possibilities are virtually endless.

The "uncompleted" projectables may be drawn directly upon 3¼" x 4" slide glasses in special ink, or on white paper in India ink for use in the opaque projector or to be photographed on 2" x 2" slides. Finished, completed drawings from various sources can be utilized by masking out with white paper the parts it is desired to remove. The preparation of incomplete written work offers no art problems.

Use of these unique visual-education materials in the classroom is obvious: they are projected upon the white chalkboard in a room which is only partially darkened. The student then completes the work by adding the missing features or names on the board with dark-colored chalk. IP will be happy to publish the opinions and recommendations of educators who have had experience with this effective method.

* * *

Tolerances and Intolerances

ON A MODERN sound recording on disc the distance between two grooves on the record is of the order of 5/1000th on an inch! A moment's reflection of the one-inch scale on a ruler, and then of the minutiea represented by the aforementioned dimension, will convey the complexity of the problems by both those who record and those who aspire to present faithfully the intelligence thus captured.

Rear-Projection Screens For 16-mm Film Showings

By JOHN DREYER

President, Polacoat, Incorporated

WE FIND in IP an inexhaustible source of technical data which induces serious thought relative to the problems which beset both manufacturer and user of audio-visual equipment. Being narrow-minded, in the sense that I think of our own product, I offer a few thoughts anent rear-projection screens.

It is only within the last few years that low-reflection, good-distribution, rear-projection screens have been available. The first extensive use of rear-projection was as the picture-finder for photographic cameras in the form of the ground-glass plate. The next fairly extensive use was for backgrounds for motion pictures. Television studios have taken it up from there.

Vast Improvement Effected

About five years ago the use of portable, self-contained picture projection units began to rise. With the improvements in projectors, as well as with rear-projection screens, this use has continued to expand, and the units offered continue to grow larger. They now contain screens as large as 37 x 49 inches, and the collapsible fold-up type units, where the projector is separated from the light-controlled area, now go up to 40- x 40-inch screens. This size uses the conventional 500-watt slide projector. With a projector beside the screen, the depth is 4 feet, 6 inches.

The self-contained units have a light-controlled dark area in back of the screen. They often make use of a mirror to reduce the size of the area required in back of the screen. The size does not stop there, for portable fold-up, rear-projection screens 9 feet by 12 feet are being made. A large permanent 17 x 33-foot rear screen has just been installed in an auditorium for training.

Permanent Installation Best

The best installations make use of a permanent screen. This can be placed *diagonally* across the corner of a room or is built flush into the wall of the room. In this way the projector, with its interference and distractions, is out of the way of the audience.

The big advantage of rear-projection comes only when the screen has a low reflection for ambient light and appears dark. The projection provides the light areas on the screen and the screen provides the dark areas for the necessary contrast.

A front-projection screen is very sensitive to ambient light and less than 1% stray light is objectionable. With the rear-projection screen, the room light is not critical. The projector light should match the room brightness. The trend toward increasing projector output is making larger pictures possible.

"Hot Spot" in Projection

You (IP) consistently refer to "hot spot." Screens of a variety of distribution curves are now being offered so that "hot spot" is eliminated. Eye-

TIPS ON TAPE SPLICING

FOR QUICK and positive adhesion of "Scotch" splicing tape, care must be taken in storing and handling the rolls. It takes only a minimum of time and effort to follow these simple rules:

Store splicing tapes at normal room temperature and relative humidity. Avoid close contact with heat. Normal temperature means 70°F, and for relative humidity, 40-to-60%.

Protect rolls from dust by keeping them in boxes or tape cans. This also preserves the high-bond characteristics of "Scotch" splicing tape. Avoid crushing package so as to preserve tape edges.

Allow only a minimum tab of splicing tape to be exposed on a dispenser, thus guaranteeing its positive adhesion.

When using splicing tape, always rub the spliced area vigorously with your thumbnail to effect a strong and long-lasting splice.

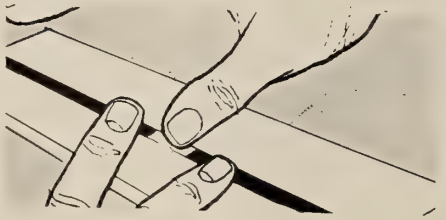
Cut magnetic tape with a demagnetized scissor. Demagnetize with a bulk tape eraser or a jeweler's watch demagnetizer.

Never cut magnetic tape at a 90° angle. This will cause a "pop" in playback. Repair broken tape by simply butting the broken ends carefully and splicing.

PROFESSIONAL METHODS FOR SPLICING "SCOTCH" BRAND MAGNETIC TAPE

Hold strips of magnetic tape securely between fingers. For maximum strength and flexibility of splice, cut at shallow angle 30° to 45°.

Butt the ends of the tape in a splicing block without overlapping them. Apply the splicing tape to the shiny side of the magnetic tape.



Apply small section of "SCOTCH" Brand Splicing Tape No. 41 to the splice. Use the 7/32" size and apply it parallel to the magnetic tape as shown. Rub splicing tape firmly with fingernail to iron out air pockets for positive adhesion.

If a splicing block is not available, lay magnetic tape on a flat surface. Join the cut edges carefully and hold in position with index and forefinger. Apply small section of ½" to ¾" splicing tape diagonally across splice and rub firmly.

When using wider splicing tape, trim extra overlap by cutting into magnetic tape slightly. This eliminates danger of adhesive gumming up recording head or sticking to adjacent strip of magnetic tape.

comfort and visual acuity are best when the surrounding light matches the screen brightness. Consequently, a smaller rear-projection screen can be used because smaller detail can be seen. Set up a rear-projection screen and turn the lights on and off. Observe the difference and the advantageous effect of the surrounding illumination.

True, the surroundings can be more interesting than the picture and hence can be distracting. However the combining and dark surroundings has put many to sleep and out of contact with the instructor.

Projector vs. TV Test Result

In an attempt to standardize U. S. Military Service requirements for motion-picture projector noise levels, training films at various projector noise levels were shown to students. The same films were also shown over a closed-circuit TV system to equivalent groups. Tests were made before and after each presentation. A comparison of the results obtained with respect to "learning" shows that the projector is the superior training device, provided low noise levels are maintained.

* * *

Emde Aluminum Slide Binder

A new aluminum binder for 3¼" x 4" lantern slide plates is now available from Emde Products, manufacturers of a complete line of aluminum-glass slide binders.

The binder consists of a one-piece aluminum frame and one piece of cover glass. The glass protects the emulsion side of the lantern slide plate glass; the two are inserted into the frame, thus completing the slide. A box of 50 aluminum frames with glass retails for $10.

Further details from Emde at 2040 Stoner Ave., Los Angeles, 25, Calif.

* * *

Transpro Projector Filters

New Transpro projection filters will give to slides or motion picture films the proper color balance by either increasing or decreasing the color temperature to compensate for tne omitted filtering needed at the time the pictures were taken, according to Enteco Industries. The eye is easily deceived by conditions that require the use of light balancing filters when taking pictures, and photographs may reflect the omittance of filters. Also, proper light balancing filters may not be immediately available.

Each Transpro filter attachment

Enteco "Transpro" projection filters.

consists of two filters attached to a mounting that easily attaches to the lens. When required, use of either filter restores a color balance to the scene, imparting a naturalness that makes it subjectively more pleasing. One filter increases the color temperature of the projector light; the other decreases. The metal mounts can withstand hard usage. A flip of the finger either positions or removes the filter in front of the projection lens.

For 8- and 16-mm motion picture projectors respectively, prices are $4.95 and $6.95. For slide projectors, prices vary from $7.95 to $9.95, depending on range. Enteco Industries, Inc., 610 Kosciusko St., Brooklyn 21, N. Y.

* * *

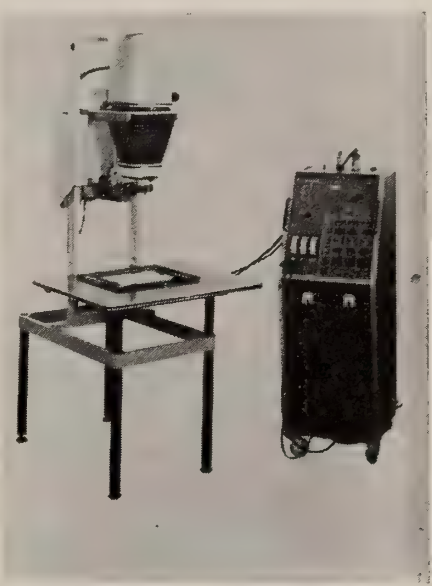
New Electronic Enlargers

Designed specifically for photographic laboratory use are two new electronic precision enlargers recently developed by LogEtronics, Inc., Alexandria, Virginia. Absolute contrast control by light alone, called LogEtration, is provided in both of the new enlargers, the Model B-5 and the Model B-10.

The B-10 Enlarger incorporates a series of operator-adjusted, precision controls to simplify the exposure process and to allow the desired variations in retention of negative detail, contrast and tone separation. Densities of the extreme highlight and shadow are determined independently of each other through two light sensitive probes. Contrast control and mid-tone separation are achieved by variable modulation of the image-forming, moving light beam from the cathode ray tube, supplemented by a variable non-image forming bias light.

Exposure control by an automatic timer relates the time and light factors to produce the proper exposure time without operator calculation. Motor-operated, magnification and reduction are variable continuously within the limits of the lens chosen.

The Model B-5 accommodates negatives up to 4 x 5 inches in size. The B-10 is a larger instrument with a negative capacity of 10 x 10 inches. Further information: LogEtronics, Inc., 500 East Monroe Avenue, Alexandria, Virginia.



The LogEtronics precision enlarger

"Select" 70-mm Yen

Paramount Theatres (505 houses at present) will install 70-mm equipment in a "select" number of "key" theatres throughout the USA, says prexy Leonard Goldenson. Less optimistically, he said, par will reduce by about 100 its present theatre holdings within the next few years, keeping only those which can be operated on a "sound economic basis." Underlining the present trend toward production of "block-buster" pictures only, Goldenson said:

"Pictures with box-office appeal gross as much, if not more, than pictures in any previous period in the history of the industry. This is true despite the great number of leisure-time activities available to the public. While changes continue to be made in the industry, its basic strength as a vital segment of the entertainment industry is attested by the fact that in 1958 approximately $200,000,000 was spent for admissions"

Distortion (Projection and Viewing) in Motion Pictures

The appended article was written and published away back in the '30's but the basic data it presents is as valid, in the main, as it was years ago. It would appear that the distortion that may be tolerated by the average spectator is greater than one might first suppose. The type of distortion discussed here should not be confused with the out-of-focus effect occasioned by film buckle.

THE whole subject of warped perspective and distortion can conveniently be divided into three phases in accordance with three causes which adversely affect true rendition of form on the screen and in the eye of the observer. These are:

1. The discrepancy between camera-point-of-view and audience-point-of-view involving the relative values of camera and projector lens focal lengths.
2. The elongation of figures and the keystone-effect resulting from projection from a point *above* the screen.
3. The error in perspective caused by the off-center view.

The three types of distortion are, of course, *additive* in their effects.

Ideal conditions of viewing appertain to only one point in the theatre—namely, a point on the axis of projection, normal to the screen, and at a distance D from the screen such that

$$D = \frac{\text{focal length of camera lens}}{\text{focal length of projection lens}}$$

X= projection distance

At other axial points, either closer to or farther from the screen, the observer sees an image distorted from its true perspective. If the focal length of the projection objective is chosen to make the point D fall near the *center* of the audience, the *average* distortion is reduced to a minimum. This viewing distance defect in motion picture projection is obviously of a nature which can not be overcome—although, fortunately, in practice it does not seriously handicap the illusion for the *average* person.

Projection at an angle and viewing at an angle also are causes of distortion which cannot be eliminated in practical presentation.

Projection Angle Distortion

The question of projection angle has been frequently discussed. It is recommended, first, that the angle be kept as near zero as possible (which is impossible). The amount of distortion is a function of the angle of divergence of the projected beam and of the angle which the axis of projection makes with the horizontal. One may express the distortion as the *percentage increase in height* which results when the picture is projected at an angle to a vertical screen.

For practical projection conditions a projection angle 17° results in an increase of image height of about 5%.

In one chain of theatres about 80% have an angle greater than the recommended 12° which is widely regarded as the limiting angle value. Since the theatres of large seating capacity have the larger projection angles, it follows that the vast majority of theatre patrons habitually see pictures which are projected an angles greater than 12°.

From some points of view it seems indeed that the 5% increase in the ratio of height-to-width is a lax enough tolerance. Consider for a moment the effect on the human figure. While the pictures of some of our Hollywood actors and actresses might undergo with aesthetic advantage a 5% increase in vertical-to-horizontal ratio, it hardly seems probable that the result would be highly satisfactory in the majority of cases.

The 17° projection angle should in its effect be roughly equivalent to the once highly-advertised 18-day grapefruit diet. Those in the lightweight class apparently lose five or six pounds by the treatment.

Magnification at Bottom

In addition to elongation of figures there is, of course, a second effect in an image projected at an angle due to the fact that the bottom of the screen image is magnified more than the top. What should be *vertical* lines in the image become *convergently* upward.

A rectangular screen shape is maintained by shaping the masking, but nothing is done to rectify the convergence of lines *within* the picture. It is well known that the eye is extremely sensitive to the lack of parallelism between two lines. In some actual cases in theatre projection the convergence amounts to five or six degrees, which is very apparent at the edge of the screen.

Fortunately, the attention of the audience is seldom concentrated on vertical lines in a picture. This is more true now than in the days of silent pictures with its numerous titles. It seems, therefore, that experimental demonstration of the practical effect of projection angle should be confined principally to such subjects as make up the greater bulk of motion picture presentation.

Reasonable Limit Urged

In preparing experiments to demonstrate and evaluate the limits of allowable distortion, one is confronted by two diametrically opposed points of view. Either one should seek to determine limits which would prevent the audience from ever seeing an image in which distortion could be recognized, or one should seek to find the limits which in the majority of cases would not allow distortion to destroy the illusion of naturalness.

In view of the data which show that many successful theatres have projection angles in excess of the arbitrary recommended limit, it seems of interest to determine the degree of distortion at which the illusion of naturalness breaks down.

A number of still pictures of motion picture scenes were reproduced as lantern slides. These were projected on a screen at vertical angles which gave progressively 2.5, 5, 10, 15, and 20% distortion. The screen picture was photographed at each position and lantern slides were made of the results.

Test Results Evaluated

All the groups of slides thus obtained were thoroughly shuffled together so that during projection no one of a series of slides would follow another of the same subject. The slides were then shown to a group of persons, each of whom was asked to select all pictures which looked

TABLE I. Summary of data showing susceptibility of an average audience to different degrees of distortion.

Subject	Relative number of observers who objected in per cent of total number of observers					
	Per Cent Distortion					
	0	2.5	5	10	15	20
Close-ups	0	0	0	0	0	20%
Semi-close-ups	0	0	0	0	5%	25%
Full-length figures	0	0	0	0	15%	50%
Well-known inanimate subjects	0	0	0	10%	40%	50%

unnatural and to state the reason for the objection.

Results of this test are summarized in Table I. In column 1 of this table, the subjects have been classified in a general way. The terms "close-up," "semi-close-ups," and "full-length figures" apply to human figures. Well-known inanimate subjects included pictures of houses, doorways, wagons (showing wheels), etc.

The remaining columns headed by the value of distortion in % contain the record of the relative number of observers who objected. Individuals participating in the test were not informed of its object and they probably were neither less nor more critical than members of the usual motion picture audience.

The conclusion from these data is that for scenes in which actors or actresses form the principal interest, the image can be distorted 10% before the illusion of naturalness is impaired. Stated in another way, this means that most persons unacquainted with what the real subject looks like are satisfied even

(*Continued on next page, Col.* 1)

Research Council 70-mm Test Film

A 70-mm projector alignment test film has been completed by the Motion Picture Research Council (Hollywood) and will be made available gratis to theatres, servicing organizations and manufacturers. It is designed to take the guesswork out of release prints. Although its primary purpose is to pinpoint proper aperture dimensions, the film can be used also for checking travel-ghost, steadiness, jump and weave, focus and film buckling.

Research Council president William F. Kelley has promised IP full technical data on this film so that projectionists will be able to realize maximum benefits therefrom.

Nitrate Film Nay in Ontario

Only safety-type film will be accepted for showing in Ontario, Canada, after July 15. Licensed film exchanges will not be permitted to keep nitrate prints in storage after the mid-July date, nor will the provincial board rule on any but safety prints.

There were only 13 theatre fires in the province during the last fiscal year, ending March 31, and only one was of serious proportions. The latter was believed to have started outside the building, obviously the Odeon at Ottawa, which was swept by flames last October after a gas explosion nearby.

Projection Angle (degrees)	Per Cent Distortion	Area Loss, Per Cent	Image Size Bottom and Top of Screen, Mm
0	0	0	—
12.5	2.5	2	0 9
17.5	5.0	3	1 3
21.5	7.5	4	1 7
24 5	10.0	5	2.0
27.0	12.5	5	2 2
29.5	15 0	6	2.6

TABLE II. Effect of projection angle upon screen definition and loss of area with rectangular masking.

though the picture is decidedly distorted.

In the case of very familiar objects of definite shape as, for instance, a picture in which there was an axial view of a wagon wheel, the tolerance is somewhat narrower — some persons objecting when the image is distorted as much as 10%.

Definition and Area Losses

This discussion thus far has been limited to true image distortion. There are two other undesirable effects, however, which accompany projection at an angle. The first is the loss of image area which follows inevitably when the sides of the picture aperture are cut to make the frame rectangular. The second is the effect upon top and bottom image definition because of the path difference.

Though neither of these can properly be classified as distortion, an evaluation of both has been included in Table II. The third column shows approximately the area loss in % which results when a picture is projected with a 6-inch lens to a rectangular vertical screen, and the fourth column shows the diameter of the circle of confusion, or, more accurately, the major axis of the ellipse of confusion at the bottom and top of the field for a perfect lens working at an aperture of F:2.

The area loss, that is the amount which must be masked from the lower corners of the picture, is not particularly serious at any commonly used combination of projection distance and focal length—provided that the elongated picture is not masked off to maintain the 3 x 4 picture.

The lack of definition as judged from a viewing distance of 20 feet becomes noticeable if the image size exceeds about 1.5 mm. Since the image size resulting from the projection angle is superposed upon the effect of the lens aberrations, it is probably reasonable to state that with practical projection lenses of F:2 aperture, definition suffers noticeably at projection angles greater than 17 degrees.

The second matter upon which some experimental data may prove of advantage concerns the viewing angle forced upon all the members of a motion picture audience except those located opposite the screen center. At first thought, this problem appears to be closely related to the former one. Both projection at an angle from the horizontal and viewing at an angle other than the normal produce a similar kind of elongation of the screen image, and one might expect that a distortion tolerance set up for the one case might apply to the other.

The conditions, however, are somewhat different: a person viewing the screen from an angle is conscious of his point of view, and instinctively makes a correction for some distortion of the image. He is not conscious of the projection angle, and therefore has no means of compensation which will aid him in rectifying his concept of the picture.

It is common experience that motion pictures viewed from extreme front and side seats in some theatres appear badly distorted. At the same time, it is true that one's enjoyment is not adversely affected until the angle becomes fairly large. The author has attempted to determine the limiting angle experimentally by projecting before a group of persons motion pictures of a screen image photographed at different angles.

Tolerable Side Viewing

There seems to be quite good agreement among the persons before whom these and other pictures of the same kind were shown that any angle less than 30 degrees is not objectionable. Forty degrees seems to be passable, but the opinion was unanimous that the illusion is spoiled at angles greater than 40 degrees.

One cannot say that these demonstrations adhere closely enough to theatre conditions to justify any general conclusions. One is quite justified in asking: How much does motion in the picture affect the feeling that the illusion has failed? And how much does the angular field of view change one's judgment?

A few trials were made in which a large black border was shown around the rotated picture. This, it was thought, would supply a comparison reference as to the amount of fore-shortening to be expected in the picture. The judgment of distortion did not seem to be much changed. Pictures filling the screen appear better to represent the view which a member of the audience has in a seat close to the screen—the only location in which the viewing angle problem is serious.

[TO BE CONCLUDED]

VIDEOTAPE RECORDER

(Continued from page 12)

the bottom to the top and blank the picture tube during this "vertical retrace" time. Both these movements must be made simultaneously at the studio and in the home. Thus the composite video signal consists not only of the picture information but also of 15,750 horizontal sync and blanking pulses per second, and 60 vertical sync and blanking pulses per second.

SERVO SYSTEMS

There are four electronic servo systems in the Videotape recorder, with three of them controlled primarily by a photoelectric cell.

An exciter lamp and photoelectric cell are mounted in the video head assembly so that light is reflected to the cell during half of each revolution of a disc attached to the head drum motor shaft. As the shaft rotates at 14,400 rpm (240 revolutions per second!), the output of the photoelectric cell is a 240-cycle square wave, the phase of which is directly dependent upon the instantaneous position of the motor shaft and thus the head drum.

During the record mode the photoelectric cell output is the original power source for the capstan motor, so capstan rotation is locked to head-drum rotation. Longitudinal tape motion, therefore, is essentially controlled by the rotation of the head drum. The photoelectric cell output is also recorded along the bottom edge of the tape as a control track.

In the reproduce mode we have a slightly more complex problem. Now longitudinal tape motion must not only be controlled by the head drum, but must also be *exactly* the same as it was during recording. The photoelectric cell output, therefore, is compared

in phase with the reproduced control track signal. Any difference in phase between the two signals, which would occur if tape motion in conjunction with head rotation, were not identical with what obtained during record, is translated into a control voltage which will speed up or slow down capstan rotation as applicable. The placement of the video heads on the recorded tracks is thus very accurately maintained.

Another servo loop is used to eliminate fast phase correction requirements for the head drum motor and ensure that the vertical synchronizing signal is always recorded at the same physical location on the tape. In this arrangement the vertical synchronizing signal is multiplied and compared in phase with the output of the photoelectric cell. Should the sync signal suddenly undergo a phase shift—for example, if an inductive load were applied to the sync line—electronic circuits will prevent the *large* error signal from immediately affecting the drum motor, but will provide a gradual correction.

The third servo circuit is also used in relation to the head drum motor to minimize any tendency of the motor to "hunt". The photoelectric cell output is used to excite a ringing oscillator. The output and input of the oscillator are compared in phase. The output will shift in phase in relation to the input if the photoelectric cell signal suddenly shifts in frequency, as would occur during "hunting" of the drum motor. This phase shift is translated into a control voltage which will act to shift the phase of the voltage applied to the drum motor and thereby correct the velocity error.

A fourth, and final, servo circuit allows the concave tape guide to be adjusted in position relative to the head assembly. This will be discussed fully in the next article (as will the other servo circuits) thus it is sufficient to state that this positioning is vitally important in getting a good television picture.

HEAD SWITCHING DURING REPRODUCE

In the record mode the video signal is connected to all four heads, with no regard for which is contacting the tape. During reproduction we must select a single head, to prevent those not in contact with the tape from contributing noise to the signal. (And also to prevent cancellation effects as two heads reproduced indentical information during an overlap period). An electronic switching arrangement, using gated tubes, thus sequentially selects a head in contact with the tape. This process is controlled so that it occurs during a horizontal blanking period, and any switching transients are not visible at the receiving set.

Reforming Synchronizing Pulses: The final circuit in the reproduce chain is the processing amplifier, which elimi-

Function of "SERVO"

"Servo" is an abbreviation for "servomechanism". It is any mechanism, or pointer, or motor, or other movable device that is forced accurately to follow the motion or position of *another* mechanism. The controlling mechanism, which must be exactly imitated at a distant point by a controlled device, is called the "master station". The controlled distant mechanism which follows its master may be called the "slave station".

The purpose is to keep two actions or indications completely in step even though they are widely separated. For example, a meter pointer reads, say, 12 on its scale. This may be the master station. A distant meter is forced also to point to the same number, that is, 12, at the slave station. This is usually done either electrically or pneumatically (by compressed air).

Precise Duplicate Action

In either case anything that happens at the master station sends current or compressed air or a compressed liquid in just the right amount to a distant station. There a motor (electric, pneumatic, or hydraulic) is put into motion and makes the slave station operation duplicate that at the master station.

These devices are used in airplanes, ships, manufacturing plants, nuclear reactors for power generation, valve controls in water supply systems, and in thousands of other uses. They are, in effect, distant hands which follow the hands of their master and duplicate his decisions and actions.

nates all objectionable noise on the synchronizing pulses and reblanks the video signal.

COMPLETELY RECORDED TAPE

A completely recorded tape contains three separate and distinct channels of information—the video signal recorded across the width of the tape, the audio signal recorded longitudinally along the top edge, and the control track recorded longitudinally along the bottom edge.

Each television picture frame occupies ½ inch of longitudinal space on the tape, recorded on 32 successive tracks across the tape. Each track represents 16.4 active horizontal lines of picture information *plus* 2.2 lines of overlapped information.

There is one other thing we can mention here, and that is a field indicating pulse which is superimposed on the control track. The photoelectric cell output is routed through a gating tube, which is controlled by the 60 cycle vertical sync, and mixed with the control signal before recording. These pulses allow cutting and splicing recorded tapes so that the home viewer cannot see where editing took place.

NOTE: The next article in this series will treat with the functional operation of the Videotape Recorder and the practical means of achieving the results noted here.

SCREEN LIGHT REQUIREMENTS

(*Continued from page* 8)

by HI-arc radiation reflected from a silvered mirror is produced by the visible radiation, and the other half by the invisible (and for projection purposes useless and damaging) infrared.

Heat-Filter Applications

The first heat filters were of the borate-glass absorption type. Interposed between the lamp and the projector aperture, an absorption filter removes about 15% of the visible light and 65% of the infrared, turning both into heat. Such a filter accordingly gets very hot, and must be adequately ventilated or it will crack.

The cooling effect of an absorption filter on the light beam is appreciable, as the heat amounts to only about 60% of what it would be without the filter. Unfortunately, about 15% of the light is lost, and screen illumination is only 85% of what it would be without the filter. The use of absorption-type filters was understandably restricted to the most powerful lamps.

Interference-Type Filter

The "dichroic," or interference-type, heat filter was a decided improvement. This type of filter is made of optical glass upon which very thin layers of special substances have been deposited. These layers *transmit* light (about 90%) while reflecting back toward the lamphouse most of the infrared (about 85%). An interference filter thus reduces the total amount of radiant heat down to 52½% of normal with a mere 10% light loss.

The foregoing data apply to the clear colorless dichroic heat filters used in theatre projection. There is another type which is still more effective in reducing heat, but because of

Ashcraft Super Cinex arclamp.

removal of some of the longer wavelengths of red light, it has a greenish appearance. The greenish heat filters are widely used in film and slide projectors in TV studios.

The interference-type lamp mirror is a dichroic filter "in reverse" because it transmits the infrared into the back of the lamphouse while reflecting the visible light to the film aperture. These new "cold" mirrors reflect about 95% of the visible light and only 10% of the infrared.

Because interference filters and mirrors either reflect or transmit radiation without absorbing it, they do not overheat. "Cold" mirrors are remarkably free from pitting, but require care in cleaning to prevent damage to the thin interference layers, which are deposited upon the front surface.

Comparison Mirror-Filter Data

Which is the better heat-reducing method, the "cold" mirror used alone or the silvered glass mirror with a heat filter of one type or another? The following tabulation of comparison data is instructive on this score:

	Relative Light	Relative Heat
SILVERED MIRROR:	100	100
with absorp. fltr.:	85	60
with interf. fltr.:	90	52.5
"COLD" MIRROR:	105.3	57.9

Reducing these data so that the intensity of illumination remains constant, it is at once seen that the "cold" interference-type mirror *used alone* is a more efficient reducer of radiant heat than any other device at the projectionist's disposal, for it removes practically half of all the heat (while giving the most light, as shown above):

Table Showing Heat Per Screen Lumen

SILVERED MIRROR:	100
with absorp. fltr.:	70.6
with interf. fltr.:	58.3
"COLD" MIRROR:	55.0

It may be seen from the arclamp tables (III-VI) that, of all HI arcs, only the Suprex, or simplified type having copper-plated, non-rotating positives, poses no heat problems when used with silvered mirrors without heat filters. In fact, we consider the temperature range of 2200°F to 2400°F to be the region where excessive damage to the emulsion (scorching and blistering) begins. This corresponds to a center-aperture total radiant flux of between 0.73 and 0.80 watts per square millimeter.

Inasmuch as the optimum performance of any arclamp depends upon its mechanical condition and the accuracy of its optical alignment, the concluding installment of this article will deal exclusively with lamp optical adjustment and allied topics.

[TO BE CONCLUDED]

Are You Moving?

If so, please notify us one month in advance. The Post Office does not forward magazines. To avoid delay, please cooperate by sending us both your *new* and *old* address.

MONTHLY CHAT *(Continued from page 3)*

mittee during the past six months are those of screen brightness; its desirable values and methods of measuring it; the question of using a visual test-pattern for checking screen illumination; revisions of projection room plans; questions of projector motors and take-ups, and difficulties incident to the starting of projector motors; requirements of sound screens; and a recently-initiated survey of theatres throughout the United States to determine not only existing conditions of projection, but also for the purpose of establishing a set of recommendations regarding theatre structures.

The reports of this *practical* Projection Committee were circulated widely within the ranks of theatre owners. Reaction? Answer: none. Now along comes the Theatre Owners of America, fronted as is eminently proper, by President George Kerasotes, with a trade-press blast about their pious intent to raise "projection" standards by the simple mimeograph exercise of issuing a questionnaire to exhibitors relative to their "wants". What "wants"?

We of the projection craft have "wanted" for years. The writer stood in the Senate chamber of the State of Connecticut in opposition to a one-man shift proposal only to be assailed as a "racketeer" by an exhibitor leader who in his own theatres was operating with *taped moving parts!*

On April 16 last we addressed ourselves to Mr. Kerasotes in terms calculated to uncover the underlying motives of the current "better projection pays" campaign. Answer? None. But the TOA has an answer to everything. IP keeps reminding these fellows who bid for increased box-office returns in terms of an excerpt from this column many months ago:

(To "Three-D", top of Col. 2)

Three-D pictures, anamorphic lenses, 5-to-1 projector intermittent movements; 35-, 65-, 70 and what-have-you-mm film sizes; a gang of different apertures in the projection room; stereophonic, multiple-speaker sound reproduction; 7-track magnetic film prints; short-focal-length lenses impossible of focus; magoptical prints, bum prints due to penurious distributors, 90-foot screens, no exchange inspection . . . In short, while they bastardize the reproduction process they constantly seek to "normalize" (reduce) the manpower level.

Naturally, IP votes "yea" to any endeavor which aims at improving the reproduction process, as it has for the past 30 years. But we ask: "whatinhell prevented any exhibitor from doing precisely that which is implied in the now-circulating TOA questionnaire?"

The answer is simple—M-O-N-E-Y. It's a comparatively simple exercise in semantics to compose a questionnaire while basking on the sun-drenched terrace at the Fontainbleu Hotel in Miami Beach (where no manpower-reducing, non-buyer of replacement parts should be caught dead); but it takes some *real* doing to present these magnetic-track film releases in such manner as to justify the outrageous admission prices prevailing today.

After the theatreowners fill-in and return the currently-circulating questionnaire, what happens? The answer that "you need this, you need that," we'll bet, will be blithely ignored the while the theatre owner consults the Southbound airline schedules.

Don't read into the foregoing any element of rancor. The guy who wrote this went to the sun-baked drill field six days a week for 14 months before moving on to other climes. But we repeat: this much ballyhooed "projection improvement" campaign offers nothing that any theatreowner could not have done on his own at anytime during the past ten years. On that we rest—even without any word from Mr. Kerasotes. After all, he has God and the exhibitor trade press on his side.—JAMES J. FINN.

AB-PT Earnings Rose in 1958

Consolidated earnings of American Broadcasting-Paramount Theatres in 1958 increased to $6,116,060, equal to $1.40 per common share, compared with $4,894,524, or $1.10 a share in 1957. Profits from theatre operations held about equal to 1957, primarily due to operating economies and an extra week's business in the 1958 fiscal year.

AB-PT last year disposed of 26 theatres either by lease termination or expiration, commercialization or sale. At the end of the year, 511 theatres were being operated by AB-PT subsidiaries.

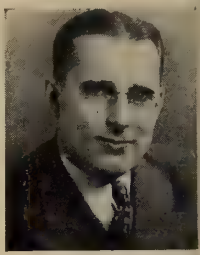
Larry Davee, Film Veteran, Prexy of Century Projector

LARRY DAVEE, long an intimate of hundreds of projectionists and other technologists in the reproduction field, has been named President of Century Projector Corp. and also named to the board of directors. He succeeds W. D. Hausler, who retired from these positions. Davee was a member of the original research team which developed the Western Electric method of sound recording on film (variable density) which contributed mightily to the successful development of motion pictures with sound accompaniment.

Many Technical Accomplishments

He has been responsible for a number of technical developments for improving the quality of professional projection and sound reproducing equipment, and in recent years has been responsible for the

LARRY DAVEE



engineering and development of the projectors for such innovations as the Waller Gunnery Trainers (Air Force); Cinerama, Cinomiracle, horizontal Vistavision, and now the new 70/35-mm projectors which will be ready shortly for installation.

His experience as Studio Manager for the Fox-Hearst Corp., Eastern Service Studios, and World Broadcasting Co., has prepared him to assist in the development and application of professional motion picture projection, sound recording and reproducing equipment for both films and records.

U. S. Film Equipment Exports

United States exports of motion picture films and equipment in 1958 were valued at $43,368,050, virtually the same level as 1957 exports valued at $43,474,-207, reports the U.S. Department of Commerce. Total exports of all types of motion picture equipment, including cameras, projection and sound equipment, and studio equipment, during 1958 were valued at $15,487,264, about 7% below 1957 exports valued at $16,689,278.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JULY • 1959

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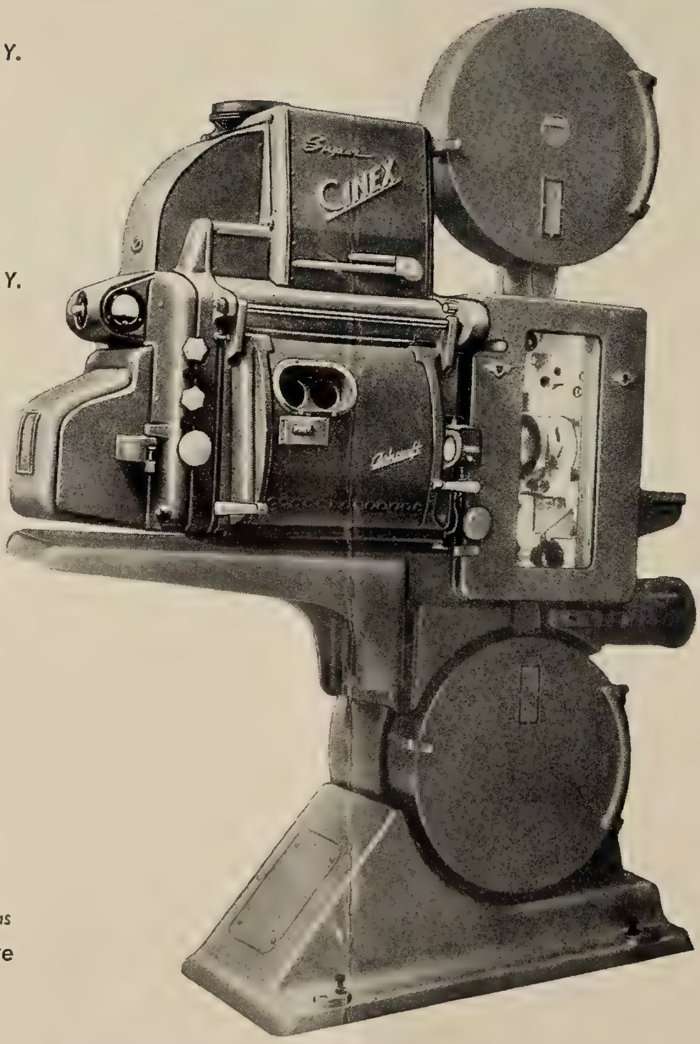

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Melbourne, Australia
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RITZ Theatre
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Corpus Christi, Texas
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Monthly Chat

Pre-Show Preparatory Time

IT'S refreshing after all these months of thrashing around with the inanities of producers, exhibitors, "star" actors whose age average is 50-plus but who still play "romantic" leads at $750,000 per picture, and the actual or imminent introduction of new and complicated production-projection processes (at reduced manpower, of course) to return to consideration of our main interest—*practical* projection. Two such current items merit the attention of all craft members.

First, a "bravo" for IA Local Union 199, Detroit, for clamping down on the 15-minutes pre-show preparatory time which heretofore has been skillfully interwoven by the exhibitors into the 40-hours-weekly contract time during which the picture was actually running. Result: to "prepare" the projectionist showed 15 minutes early on his own time. No more. Either the exhibitors now revise their schedules 15 minutes downward or pay for the extra time.

All to the good. But one angle of this development disturbs us. We'll wager with any 25-year projectionist that he can't properly prepare his show within 15 minutes! We're talking about "regular" shows, including CinemaScope; processes like Todd-AO, Cinerama, and Cinemiracle are covered by special deals. This isn't so much a question of 15 minutes extra paytime as it is of efficiency.

Projection Room Film Repairs

THE MINNESOTA STATE IA Association has requested its projection affiliates not to repair prints received in poor condition without making an appropriate charge therefor. The new procedure was set forth as follows in a letter to all film companies:

"When a print is received . . . requiring other than routine inspection and repair, an off-shift projectionist shall be called to overhaul it (with) his time to be billed to the *film company* at the prevailing overtime rate. . . . If we must take over the duties of film inspectors, we . . . refuse to do so on a gratis basis."

This move, obviously a last-ditch effort to aid exchange workers by restoring some order to the shambles that *all* exchanges are and have been for many years, has been approved by the IA General Office; subsequently the Missouri State Association followed suit.

Several questions suggest themselves anent this development. What constitutes "routine" repairs? What happens to the 15-minutes "preparatory" time when the projectionist encounters a bum print (and they number in the hundreds, especially in other than first-run spots), particularly on film-delivery days? And just who in hell has been manning exchanges for all these years that perfectly frightful conditions prevailed? And how many reels of film is an inspector supposed to handle each day? And just how long prior to showtime must a projectionist show in order to inspect seven reels of film in order to spot non-routine repairs? An hour or more?

Made to stick, this plan will occasion many one-hour (and more) shutdowns. If it helps the hapless exchange worker, fine; but it will need some sharp teeth to penetrate the film companies' hides.

AT LEAST 131 installations of 35/70-mm projector installations are in prospect in the U. S. and Canada within the next several months, according to a survey made by Universal Picture branches. Of this number, Todd-AO has 65.—J. J. F.

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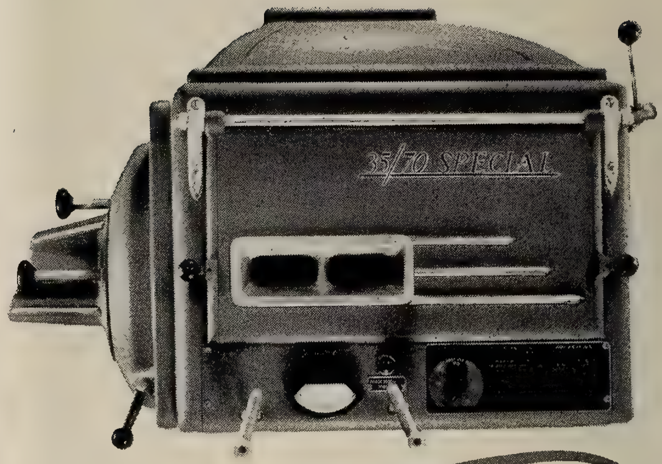

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INTERNATIONAL PROJECTIONIST

Volume 34 JULY 1959 Number 7

Screen-Light Requirements in Modern Projection

By ROBERT A. MITCHELL

Three important details must be considered in "lining up" an arclamp for maximum screen-illumination efficiency: (1) projection lens "speed" (2) freedom from obstructions to the full width of the light beam, and (3) shutter transmission efficiency.

II. OPTICAL FACTORS IN ARCLAMP PERFORMANCE

MODERN arclamps have effective optical speeds of F:1.9 to F:1.8 or F:1.7, the faster speeds being common with large 18-inch mirrors set to the prescribed working distances. The new "blown" arcs utilize main mirrors fully 21 inches in diameter which, at a working distance of 41 inches and a depth of 5 inches, represents an optical speed of $36/21=F$:1.7.

Owing to the cylindrical light-source characteristics of the "blown" arc, the pickup angle of the light source is increased to 260 degrees. (The conventional arc limit is approximately 155° to 160°.) To make use of this increased pickup angle, a spherical reflector is located behind the positive carbon to gather light that would ordinarily be wasted. This light is directed back to the main light source, and increases the total lumens on the screen by about 12% to 15%.

A projection lens of a given speed (focal length divided by clear diameter) optically matches a lamp mirror having the same speed rating when the film aperture is considered as a mere pinpoint. A real 35-mm aperture has an area of approximately one-half square inch and a diagonal of about an inch. This means that the projection lens must actually be "faster" than the lamp to "match" the mirror at all points—at the sides and corners of the aperture as well as at its center.

From a practical point of view, therefore, the brightest and most uniform screen light will be obtained when the most rapid lenses are used—lenses which numerically exceed the speed rating of the lamp optics, wherever this is possible. For this reason the published lumen outputs of the "blown" and other modern arcs are those obtained when F:1.7-F:1.8 coated lenses are used.

Question of "Optical Speed"

A certain 18-inch mirror lamp burning rotating-positive carbons works at a mirror-aperture distance of from 34 to 36 inches. Subtracting a mirror depth of 4 inches from these working distances, the optical speed of this lamp is accordingly F:1.7 at the shorter working distance and F:1.8 at the longer. Such a lamp likewise gives the rated number of screen lumens with the various carbon trims it takes when F:1.7 projection lenses are used.

But the optical speed of a lamp mirror is not necessarily an indication of the illumination efficiency of a lamp. Much more significant is the angle of light pickup from the positive crater. This factor is governed by the size of the mirror and the "geometric focus," or distance between the carbon crater and the center of the mirror.

The marked superiority of the newer lamps over older models is due in great measure to their increased angle of light pickup. (Other factors are involved, such as the magnification factor of the mirror; but this topic may be dismissed for the present with the observation that all American lamp manufacturers employ magnifications best suited to the diameter of the positive craters obtained with specific carbon trims.)

Mechanism Obstructions to Beam

Many of the older projector mechanisms were designed long before modern high-speed lenses and lamp mirrors had been thought of. The older mechanisms were accordingly built to accommodate only the lamp and lens equipment of their day. Old-time lamps and lenses had, at most, speeds of from F:2.3 to F:2.5. Such mechan-

isms cannot transmit to the screen the full advantages of modern lamps until they have been cleared for the wider beam angles involved in modern projection.

Most of the older projector mechanisms have so many miles of service on them that they should be traded in for up-to-date equipment rather than attempt the sometimes extremely difficult task of enlarging their light acceptance.

Such new American projectors as the Simplex X-L and the Century HH incorporate larger lens mounts, film cooling, curved gates, improved intermittent movements, and more efficient shutters, and are superior to many of the best foreign mechanisms.

Arclamps of American manufacture are by far the most powerful and satisfactory to operate, and are used all over the world for this reason.

Shutter Efficiency

The efficiency of the projector shutter is limited by its type and by the rapidity with which the intermittent movement effects the film-frame shifts. It is well known that the old single-rotor rear fan shutter is the least efficient of all because of the relative long time it takes to cut through the full width of the light beam. In order to avoid the appearance of "travel-ghosts" on the screen when this type of shutter is used, the blades must have a somewhat greater angular width than the theoretical minimum for the type of intermittent employed (90° for the conventional 3-to-1 movement, 60° for the high-speed, 5-to-1 movement).

The double-rotor rear fan shutter, by halving the cutoff time, is more satisfactory. Its two rotors revolve in opposite directions and cut the light beam from two sides at once, meeting in the middle. The Century HH employs such a double shutter, as do also the older Brenkert BX-62 and BX-80. (The Simplex E-7 employed front and rear shutters mounted on the same shaft to function optically like a double rear shutter.)

The cylindrical, or barrel-type, shutter has been used only in one American projector, the Motiograph, but it is extremely popular in Europe. This type of shutter is double-acting because, as one edge of a blade cuts down into the beam, the opposite edge of the other blade cuts up into the light. Although efficient, the size of the barrel shutter severely limits the size of light beam which it can accept.

The conical, or dished, shutter employed in a few European machines and in the Simplex X-L is very efficient because of its large diameter and the proximity of its light-cutting plane to the film aperture. The arclamp beam has its smallest diameter at this point. Conical shutters for 3-to-1 intermittents have a blade width in the neighborhood of 90° for a light transmission of 50%, although slightly narrower blades are available for drive-in theatres where screen light is a problem. (Drive-in shutters show "travel-ghost" when used for projection on bright indoor screens.)

For the new Simplex X-L Hi-Speed 5-to-1 intermittent, conical shutters having 63° blades and a light transmission of 65% are used. The advantages of Hi-Speed intermittents in theatres of all kinds are numerous.

Measuring Shutter Transmission

The transmission of your projector shutters can be measured by either of two methods:

(1) Measure the angular width of one of the blades. Multiply by the number of blades (usually 2) and subtract the result from 360 degrees. Divide the answer by 360. Example: A blade of a 2-blade shutter measures 92°. 92 x 2 = 184. 360 – 184 = 176. 176/360 = 48.9%

(2) Strike the arc, and with no film in the projector, but with the shutter running, have an assistant take a light-meter reading (foot-candles) at the screen. Repeat the process *without* the shutter running, taking care not to leave the light on the lens too long. Divide the reading

70-mm Projector Test Film From Research Council

In anticipation of the release within the next year of about a dozen 70-mm films, and the installation of about 150 of the new 35/70-mm projectors for showing these films, the Motion Picture Research Council has prepared a 70-mm projector alignment film. The film can be used to file and measure apertures, judge jump and weave, and check "travel ghost," focus and buckling.

Although the recommended 70-mm projector aperture is 1.913″ maximum (width) by 0.866″ maximum (height), apertures of larger and smaller sizes have been used. Therefore, the test film chart has both vertical and horizontal scales which allow the measurement of such apertures.

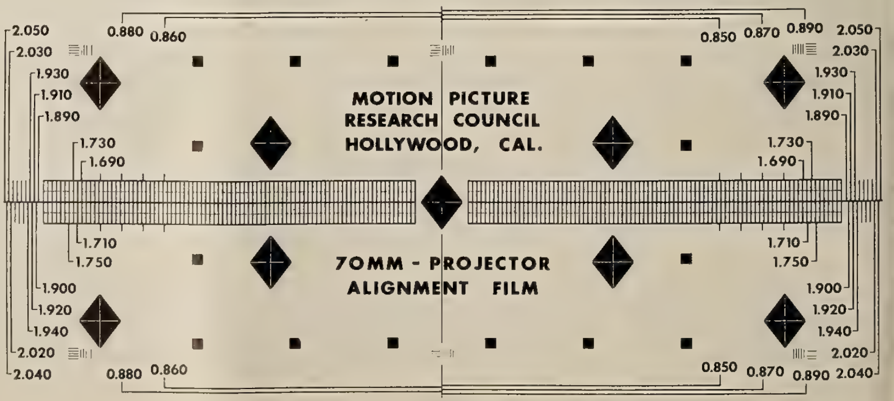
Wide Range of Indicia

The chart allows the measurement in width from 2.050 to 1.690, and in addition the slightly elongated marks along the horizontal center pattern represent dimensions in 1.3″, 1.4″, 1.5″, and 1.6″ which are available if required. All Vernier lines on the top, bottom and sides are 0.002″ thick spaced 0.010″. The vertical center line of the target is identical with the film, *i.e.* 1.377″ from the guided edge.

Magnetic stripes without sound have been applied along both edges outside the perforations in order to make this test film identical in thickness with 70-mm release prints so that a different adjustment is not necessary between this test film and a release print.

The film, together with instruction sheet, is available from Council under Code No. PA-70 at a price of 47 cents per foot at a minimum length of 100 feet or in increments of 100 feet up to 600 feet maximum. Council address is 6660 Santa Monica Blvd., Hollywood 38, California.

Pattern for Research Council's new 70/35-mm projector alignment film.



with the shutter by the reading *without the shutter.* EXAMPLE: Tests with a light meter indicate 13.3 foot-candles *with* the shutter, 27.2 foot-candles *without* the shutter. The shutter transmission is 13.3/27.2 = 0.489 = 48.9%

Use one method as a check against the other, making your blade-width and foot-candle measurements as accurately as possible. The results obtained by the two methods should agree quite closely, but probably not exactly because the light-meter method is less accurate even though more direct. Shutters for indoor projection should have a transmission of from 45% to 50% when conventional intermittents are used. Shutters for drive-in projection on large screens should transmit from 50% to 55% of the light with the same type of intermittent.

Internal Lamp Alignment

The first step in lining up a lamp is to make sure that the lamp, itself, is a perfectly functioning unit. Few difficulties will be experienced with the new rotating-positive mirror lamps because of the short protrusion of the positive carbon beyond the head which feeds it. Suprex, or non-rotating H-I lamps, on the other hand, require accurate positioning of the positive-carbon "V" guide to prevent the carbon from gradually tilting up or down as the positive jaw gradually approaches the end of its run.

To test positive alignment in simplified H-I lamps, remove the negative carbon and feed through a *straight* positive by hand, carefully measuring the height of the carbon above the lamphouse floor at the point where the crater is supposed to be. The carbon should remain perfectly horizontal at all times: if it is seen to tilt either up or down as the carbon jaw approaches the "V" guide, raise or lower the guide, as required, to maintain horizontal positioning of the positive carbon and prevent the crater from moving off the optical axis and burning slantwise.

Projectionists who have never operated modern arclamps may rest assured that mirror lamps having rotating positives and automatic photo-electrically-controlled carbon feeding and crater positioning are actually easier to operate than old-style simplified H-I lamps burning non-rotating positives. Such crater-control systems as the Ashcraft "Micronic" and the Strong "Lightronic" make incorrect feeding with discolorations and light loss on the screen virtually impossible!

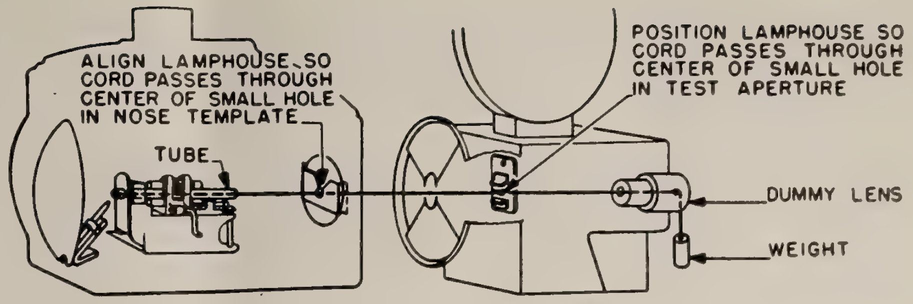


FIG. 1. Utilization of Strong Electric Co. arclamp alignment kit.

The new "blown" arclamps are likewise fully automatic, maintaining the positive carbon-tip protrusion of 3/8 inch to within 0.004 inch variation. What a difference from old-fashioned lamps that require constant supervision—and even then lose arc focus in spite of all the projectionist can do!

Alignment with Mechanism

The recommended mirror-aperture "working distance" should be established when a lamp is lined up with the projector mechanism. Working distance is measured from the film plane at the aperture to the center of the mirror (or inside edge of the mirror center hole in Suprex-type lamps). The lamphouse may later be moved toward or away from the projector head by ½ inch either way—a total leeway of 1 inch—to compensate for differences in the mirrors, if necessary.

Alignment of the lamp optical axis with that of the projector head is *absolutely necessary* for maximum brightness and an even field of snow-white light on the screen. The alignment tools recommended by the lamp manufacturer may be obtained through supply dealers; but when these are not available, a straight steel rod having the same diameter as a positive carbon and long enough to extend from the center of the mirror (but not touching it!) out through the lamp and mechanism and through the projector lens-holder may sometimes be used.

Strong Electric Co. Kit

The aligning rod should be positioned in the centerhole of a dummy lens barrel or otherwise suspended in the optical axis of the lens-holder. The other end should be clamped in the positive carbon jaw. If the end of the rod comes up to the center of the mirror, a condition of optical alignment prevails *if the rod also passes through the center of the lamphouse light cone and the center of the film aperture.*

It is usually easy to tell whether the lamp is off the axis although parallel to it, or askew to the axis of the mechanism.

For use with lamps of its own manufacture, Strong Electric Corp. supplies an aligning kit consisting of a length of string through a dummy carbon, a light-cone centering template, a test aperture plate having a small centerhole, and a dummy lens.

To use these tools (Fig. 1) prop the fire shutter open, open the changeover douser, and turn the mechanism over by hand to clear the shutter blades from the light path. Remove the projection lens, pass the dummy carbon with attached cord through the lens-holder and all the way through to the lamphouse, where it should be clamped in the positive-carbon burner assembly. Place the dummy lens in the projector and insert the test aperture in the film gate. (The test aperture is held in place by closing the film trap.)

Tentatively position the lamp so that the string passes through the center of the hole in the test aperture. Then insert the light-cone template in the lamphouse nose and further position the lamp sideways or up and down so that the string passes *exactly* through the centers of the holes in both the test aperture and the light-cone template.

Alignment may be checked by simple sighting. Open the lamp douser and the fire shutter, and turn the projector by hand to get the shutter blades out of the way. Remove the carbons from the lamp and the lens from the projector. Sight through the center of the lens-holder and observe

(Continued on page 21)

Projection "Expert" Serves up Pap

By RENE LEFEBVRE, Saco, Maine

NOTE: The appended commentary, while not quite in line with IP's policy of not publishing negative statements anent material appearing in other publications, is presented because it is typical of the many such communications received.—EDITOR

ORDINARILY projectionists are indifferent to the so-called technical data relating to projection which appears in the exhibitor trade press because such material does not delve deeply enough into the technique of the art to do much good or much harm to anybody, much less any projectionist with some degree of savvy.

Of late, however, the conductor of one of these "technical departments" in an exhibitor paper has been dabbling with technical matters about which he obviously knows little or nothing and in the process of laying it on the line as gospel has been turning out batches of outright pap. So energetically is this fellow continuing his little siroccos of hot air and misinformation that it's about time to pull the check rein.

Hum and Speaker Check

For instance, when discussing hum pickup he omits mention of the most important precaution against such a happenstance when light and speaker lines are run in proximity—that is, the use of *twisted* leads for one or the other. As much hum can be picked up by induction as by a direct connection or the use of a common ground wire!

Again, in reference, to drive-ins he states that the speakers must be checked *every day!* Well, he's a whizz if he can check 1000 or more speakers every day and still have time to inspect and repair his prints, clean, adjust and lubricate his projectors and do a variety of other chores.

He refers to his test reel as ranging from "40 to 800 cycles"—obviously a misprint of "8000 cycles". Even so, why recommend the plotting of a frequency-response curve every three to six months? If a satisfactory level of response can be obtained at 8000 cycles alone, is it not safe to assume that all lower frequencies down to the 40- or 50-cycle limit of the system are coming through?

This writer knows of no amplifier or optical-reproducer factor which would attenuate the low frequencies while maintaining normal high-frequency response. The "lows" are usually lost at the speaker cone, a fact that our "expert" may discover one day while he's checking his 1000 speakers.

Our boy also advocates cleaning vacuum-tube prongs with very fine *emery* cloth. Positively—if one wants to induce crackles, pops, distorted sound, loss of volume and other unpleasant results of "shorting" sensitive plate and grid circuits with conductive emery dust! Very fine sandpaper is bad enough for this purpose, but at least the sand dust does not conduct current.

"Out of Focus" Optical Lore

When our "expert" sounds off about short-focus lenses being very sensitive to film buckling (which is true) he goes on to say that the contemplated expedient of moving the projection room farther away from the screen "probably would not have improved the definition to any great extent."

Why not? A greater "throw" would permit the use of lenses of longer focus. Nothwithstanding the desirability of water-cooled curved gates, an increase in lens focus depth is a more certain deterrent to the out-of-focus effects he mentions.

Filtering the Nonsense

To top off his minuet of gay, carefree projection—mad, merry fun with frequency curves to plot, tube prongs to scour, and 1000 speakers to check every day—our "expert" pontificates that water-cooled film gates should be used "in place of" heat filters to keep the film cool! Water-cooled gates keep the mechanism cool, not the film, except as the conduction of heat to the edges of the film is involved.

Does he propose to reduce irradiation of the film, with the prevention of buckling and emulsion blistering, with water-cooled gates? This writer thinks he does. Well, then, the "blown" arclamps he mentions employ "cold" mirrors, so no heat filters are needed with them; but other arclamps he mentions will buckle film severely at 145 amperes and blister hell out of it at 160 amperes—*unless* heat filters are used. He spouts about better focus and then states that the most effective reducer of radiant heat isn't necessary!

We'll keep an eye on this fellow because he's a sure bet to provide further entertainment.

New 9-mm H-I Carbon From National Ups Light 10%

A new 9-mm high-intensity positive projector carbon that can produce up to 10% more light for today's larger theatre screens is now available from National Carbon Co. Amperage for the new carbon has been increased from the previous 75- to 85-ampere range to a top of 90 amperes, and this increase in current makes possible more light at the same burning rate.

This additional light is especially important to 9-mm projector systems operated in connection with today's giant screens that demand more screen light for optimum performance. If the operator chooses, the new carbon can be operated at the same light level, at which rating it will burn up to 12% longer.

A new formulation used in the manufacture of the 9-mm H-I carbon provides for greater arc stability, even at the higher current rating. Additional data from National Carbon Co., 535 Fifth Ave., New York 17, N. Y.

Correct Picture Image a Matter of Proper Design

On the basis of a number of observations in theatres during the projection of pictures, it appears that motion in the picture does not affect the result to any great extent.

A seat which forces one to see any part of the picture at an angle greater that 40 degree is undesirable. For full-length figures the judgment is more critical.

Distortion Remedies

Many attempts have been made in the past to cure the evil of viewing angle distortion—usually by the use of curved screens. Anamorphic lens systems also have been suggested. The fallacy of such suggestions have been pointed out frequently. There is, of course, no remedy except proper design of the seating space. Any correction of the screen image for one position can be made only at the expense of the perspective from other positions.

Correction of projection angle distortion is not so impossible theoretically. Partial compensation can be affected by tilting the screen. This means probably presents some mechanical difficulties, since it is not commonly used. Other partial remedies are at least theoretically possible.

"Truth" or Practicality

Whether distortion limits should be based upon the ideals of truth or upon the ideals of showmanship is the most difficult question to decide. Putting the results of the experimental data in the classic form attributed to Barnum, most of the people most of the time are totally fooled, up to a projection angle distortion of 10%. All of the people all of the time are dissatisfied with a seat which forces them to see part of the screen at an angle greater than 40 degrees.

The Videotape* Recorder

By GEORGE B. GOODALL

Ampex Corporation

This fourth in a series of articles discusses the mechanical and electronic assemblies employed in recording and reproducing the video signal. Preceding articles described the basic principles of recording conventional audio and video on tape.

IV. RECORDING AND REPRODUCING THE VIDEO SIGNAL

The complete Videotape Recorder, contained in one console and one double rack.

WE WILL now examine the actual Videotape Recorder, and the circuits it employs to record and reproduce the television picture. The equipment is contained in one console assembly and one double-rack assembly; the complete weight is 1465 pounds. The machine draws 3.5 kilowatts from a 110/120-volt 60-cycle, single-phase power source.

The tape transport of the Videotape Recorder is very similar to the mechanical assemblies used in professional quality audio recorders. It employs three motors, one each for the supply, takeup, and drive systems. The tape moves from the supply reel on the left, around a reel idler and tension-arm arrangement, then across the video head assembly and the stationary control track head. It next passes the audio head stacks—first the erase head and then the audio record/reproduce head.

Next in the path of tape travel is the capstan and its associated capstan idler, then the takeup reel idler and tension arm, and finally the takeup reel at the right of the transport. A safety switch, associated with the spring-loaded supply tension arm, automatically disconnects power to the reel motors whenever the tape supply is exhausted. Fast winding modes of tape travel are provided by the conventional means of reducing power to one reel motor while applying full power to the other, and normal operating tape speed is controlled by the capstan and idler.

The Video Head Assembly

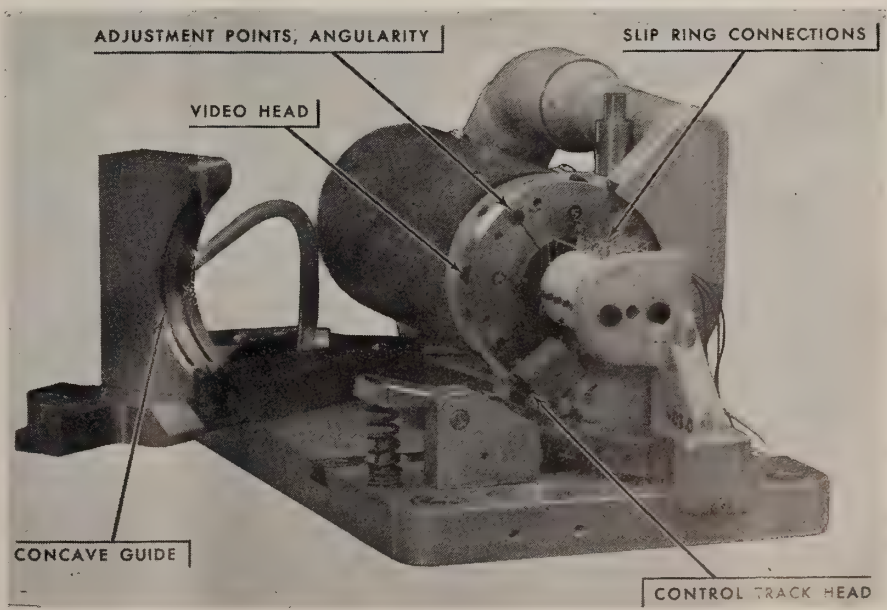
Four magnetic heads are mounted at 90° intervals on the periphery of a rotating drum. The head drum rotates at 240 revolutions per second, which, in conjunction with the two-inch diameter of the drum, provides a head-to-tape velocity of approximately 1500 inches per second. The angular placement of the heads on the drum is initially aligned to within one microsecond, then brought into perfect 90° alignment by the use of tapered screws which act as wedges in slots on the drum. These wedges act to increase or decrease the spacing between the pie-shaped segments of the drum, and provide an extremely accurate adjustment of the 90° separation between heads.

Any departure from this precise angular alignment of heads would result in time delay, or time positioning, effects in the picture information, with a consequent misplacement of each head band (consisting of 16 lines) in respect to adjacent bands.

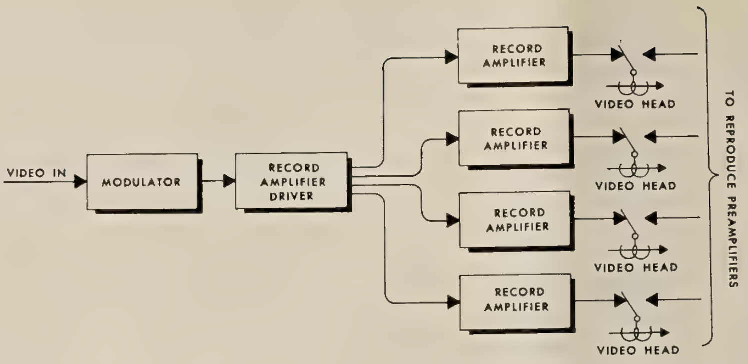
The positioning of the concave tape guide in respect to the head assembly is another important consideration. The protrusion of the head tips, necessary for good head-to-tape contact, results in the tape being slightly stretched (in width) as the heads move across it.

This result is used to advantage in certain situations. For example, if a recording were made using a new video head assembly, two points of information on a recorded track would be spaced a certain physical distance apart. If that recording were then played back on equipment with a video head assembly which had been worn down by repeated usage, the slight difference in the circumference would result in a slower speed of the head as it passed over the recorded track. It would therefore take longer for the head to pass over our two reference points of information, and a timing error would be introduced. (Any timing error in excess of 0.05

This view shows some of the more important features of the video head assembly. The concave guide has been swung away from the head drum to provide a better view.



*Trademark, Ampex Corporation.

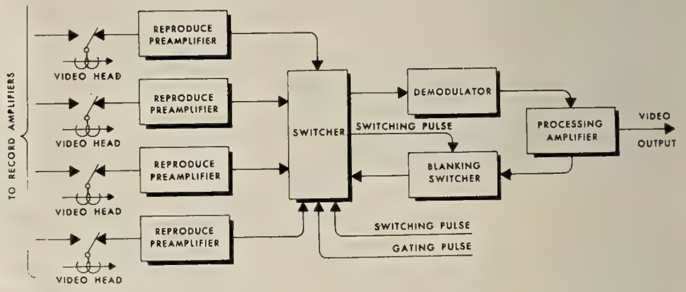


Simplified block diagram of components in the recording path.

microseconds is noticeable in the television picture.)

If we had stretched the tape slightly more in record than in reproduce, we could have eliminated this timing error. The positioning of the concave tape guide controls this stretching, and it can be adjusted manually or automatically either closer or farther from the rotating heads.

The adjustments noted here (head angularity and tape guide positioning) are set to a standard norm by reproducing a head alignment tape manufactured under controlled laboratory conditions at the Ampex factory. All tapes can thus be recorded under universal conditions, and complete interchangeability from machine to machine is assured.



Components in the reproduce path are represented in this simplified block diagram.

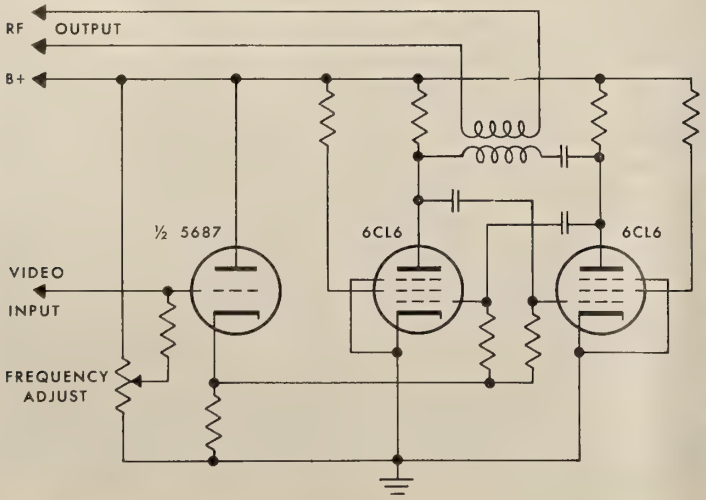
Magnetic Television Tape

Improved manufacturing techniques have resulted in an average head life now far in excess of the originally anticipated 100 operating hours. Picture quality is not affected as the heads wear down; on the contrary it improves silghtly in some respects. The end of the useful life of the head might be black smears appearing in the picture, a gradual increase in noise level, or clogging of the heads themselves as they lose their self-cleaning action.

Signal "dropouts" occur when surface defects are present on the surface of the magnetic tape. As we have seen before, the actual magnetization medium is iron oxide, which is ground to a very small size and distributed as uniformly as possible on the tape backing. If, in spite of all reasonable precautions, these particles form nodules on the surface of the tape, the tape will be lifted away from the head assembly as the nodules pass. This will result in a signal dropout at that point, not noticeable in audio work but quite apparent in video. This effect also occurs as the tape surface breaks down after repeated passes across the video head assembly.

Special television tape with improved surface characteristics and harder, wear-resistant coatings has been developed. Transverse orientation of the magnetic material with the axes of easy magnetization in the direction of recording (transversely) has resulted in an improved signal-to-noise ratio. Response has improved with the smoother coating, and the wear-resistant quality of harder binders has increased the life expectancy of the tape to well over the 100 passes which initially was considered the practical maximum.

Neither resolution nor linearity are affected as the heads wear the tape in repeated passes. Increasing dropouts, as the tape surface breaks down under repeated playings, practically always indicate the end of life of a tape.



This simplified schematic diagram of the modulator shows the multivribrator carrier generator, the cathode - follower input, and the transformer-coupled output.

Recording the Video Signal

The incoming video signal enters the equipment at the modulator section of the Modulator/Demodulator assembly. In this unit it is first amplified, then applied through a cathode follower circuit to the grids of the multivibrator carrier generator, with a resulting frequency modulation of the 5-megacycle carrier.

This f-m signal is next fed to the Record Amplifier Driver assembly, where it is amplified and channeled into four identical, low-impedance outputs, which are routed through coaxial cable to four record amplifiers in the Record Amplifier/Reproduce Preamplifier assembly. The output of each record amplifier is fed through slip rings to its respective video head on the rotating head drum. Each head is thus constantly supplied the signal, and records that signal when it is in contact with the tape. Note that no bias voltage is necessary in f-m recording.

Reproducing the Video Signal

Recorded magnetic flux on the tape induces a voltage in the moving video heads as they cross over the recorded tracks. This signal is routed through

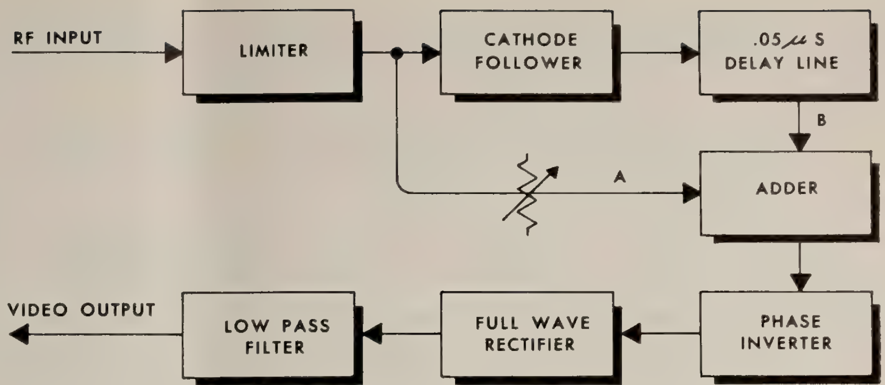
slip rings to the reproduce preamplifier section of the Record Amplifier/Reproduce Preamplifier assembly, with the output of each head fed to a separate preamplifier.

The amplified outputs of the preamplifiers are connected to the Switcher assembly, which (in conjunction with the Blanking Switcher assembly) sequentially gates and integrates the signals. The instant of switching from the output of one head to that of another is controlled, by the Blanking Switcher, so that it occurs during a horizontal blanking interval, and any transients generated by the switching action are not visible at the home TV set.

From the Switcher the now integrated signal is fed to the demodulator section of the Modulator/Demodulator assembly, which returns the signal to its original a-m form. The final circuit is that of the Processing Amplifier, which removes all objectionable noise on the sync pulses and reforms the blanking signal.

The output may now be fed thru the station master control and thence to the TV transmitter.

Most of the circuits used in the recording and reproduction of the video signal are distinguished only by their conventional configuration, and we need not spend our time studying them. However, the modulation/demodulation, head switching, and signal processing demand more thorough treatment.



Simplified block diagram of the delay line demodulator shows the functional details of this circuit. The input signal is split in two paths—A and B—with B going through the delay line.

Modulating and Demodulating the Video Signal

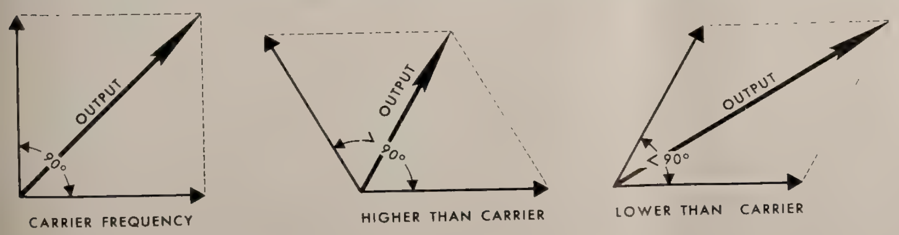
Frequency modulation is employed in the Videotape Recorder for two basic reasons: first, the use of the carrier eliminates the problem of reproducing low frequencies and, second, it overcomes many of the problems inherent in the revolving multi-head approach.

We have already throughly covered the reasons why it is difficult to reproduce low frequencies. In the Videotape Recorder, if our carrier is five megacycles, we can drop three octaves to a little under one megacycle and still maintain an adequate signal-to-noise ratio. This four-megacycle bandpass is sufficient for a television signal conforming to U.S. standards. Therefore, the simplest manner of utilizing the available spectrum is to modulate the five-megacycle carrier with the four-megacycle video signal *and use only the lower sidebands.*

The rotating heads chop the signal 960 times per second. Despite all care, it is impossible to manufacture heads with identical outputs, and the limiting action of frequency modulation eliminates the variation in signal level produced by the multi-head device.

It is usually assumed in f-m work that the modulating frequencies and the frequency of deviation will be small compared with the carrier. These concepts could not be followed in magnetic recording, as a 40-megacycle carrier was implied, and it was impossible to predict exactly what would happen when both these assumptions were ignored and the lower sidebands were utilized. (In fact, Enzo Cambi, in the January 1948 issue of the PROCEEDINGS OF THE I.R.E., published findings indicating that the *upper* sidebands would contain most of the energy.)

Showing the action of the delay line demodulator. As the frequency rises or falls from the carrier frequency the phase angle of the *delayed* signal and the *undelayed* signal becomes more or less than 90°. The vector addition of the two signals results in an output amplitude that varies with frequency.



Quite truthfully, Ampex answered the question by simply building the equipment and testing it — and it worked! In the Videotape Recorder the carrier frequency is five megacycles, deviation is two megacycles, and modulating frequencies range from zero cycles to four megacycles. The equipment therefore must have a minimum passband from one to seven megacycles.

The modulating process uses a balanced multivibrator circuit, which essentially prevents the modulating frequency and sidebands from adding together. The simplified schematic diagram illustrates the type of circuit necessary.

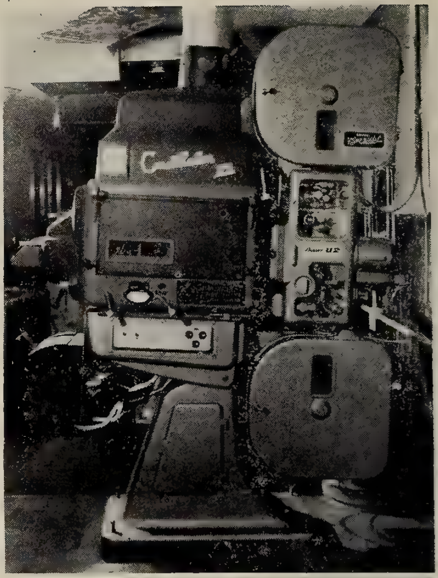
During replay, the signal enters the Demodulator (from the Switcher) and is first subjected to 60 db of limiting action. The signal is split at the output of the final limiter stage, with one path going directly to the grid of an adder tube, and the other proceeding through a delay line before being connected to the adder tube. The delay is chosen to present a 90° phase shift at the carrier frequency of five megacycles.

The vector diagram illustrates the action when the carrier frequency, then lower and higher frequencies are passed through the circuit. As shown, the vector addition of the original signal and delayed signal results in a larger output at the lower frequency, and smaller output at the higher frequency. This is simply a matter of the delay being more or less than 90° as the frequency rises or falls. The resultant amplitude will thus vary as a function of frequency. The demodulated frequency, of course, is depend-

(*Continued on page* 17)

35/70-mm All–System Projector by National Theatre Supply

Here are the details of the new "Seventy" dual-purpose (35/70-mm) projector and sound system just now being installed in key theatres in the United States. The projector is manufactured by Eugen Bauer Co., of Stuttgart, Germany, a leading maker of such equipment for more than 50 years and with installations throughout the world.



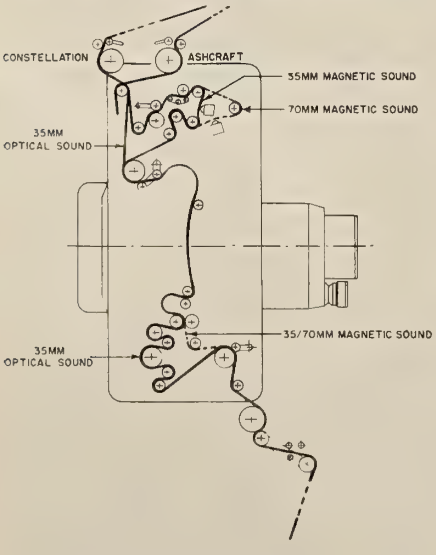
An installation of the National "Seventy" (Bauer) 35/70-mm projector. Magazines hold up to 4500 feet of film. Projector "start" and "stop" buttons are shown in pedestal under lamphouse. "Constellation" arclamp is made by Strong Electric Corp. exclusively for National Theatre Supply.

THE Seventy is adaptable to all present sound requirements, both optical and mechanical. It may be converted from 70- to 35-mm operation within two minutes, the process being simplified by the fact that the pad-rollers holding the film in the sprocket teeth do not have to be changed. A turn of the eccentric sleeve on the roller bracket suffices for this change. All parts that require changing are *coded* for either 70- or 35-mm operation, thus there can be no mistakes.

Separate sprockets are provided for each film width. The sprockets that must be changed when converting are the two feed and takeup sprockets (24 teeth with 35-mm, 30 teeth with 70-mm); the intermittent sprocket (16 teeth with 35-mm; 30 with 70-mm); the driven sprocket on the 6-channel magnetic soundhead (either 24 or 30 teeth, respectively), and one guide roller.

Magnetic and Optical Sound

The film gate and film trap are mounted on steel guide pins and are slipped off in a single motion. The correct slip-in-type aperture is replaced with the trap. Lenses for each system are mounted in quick-change holders that can be removed or mounted in place by loosening or tightening *one* clamping screw. Pre-focusing insures proper focus. A change is accomplished by moving the drive motor closer or farther away from the projector mechanism. Two quick-lock levers facilitate the change.



Film threading path for National "Seventy" projector. Constellation arclamp indicated at top left, Ashcraft lamp at top right.

The roomy, fully enclosed projector housing includes optical and magnetic sound components as an integral part rather than separate, added-on units. Alignment problems are eliminated: a direct gear-coupled drive motor may be utilized with a corresponding reduction in shafts and gears, and film threading is facilitated.

Converting the magnetic soundhead from 4- to 6-channel sound reproduction is unnecessary, for the soundhead contains two separate scanning heads: one for 35-mm, 4-channel film, and one for 70-mm, 6-channel film. A switchover device, set in operation automatically when the film is laced over the magnetic scanning head appropriate to its particular width, prepares the amplifier equipment for reproducing the sound from either 4 or 6 channels, thus ensuring top quality and maximum possible life of the heads.

The optical soundhead, an organic whole with the projector head, is equipped for reproducing the sound from normal optical-track films, but also enables the scanning of those working on control-frequency systems (Perspecta-sound). The scanning slit can be limited in its width for a perfect match to the particular width of the soundtrack.

Film Speed, Curved Gate

Three large fly-wheel-controlled rollers provide constant film speed. Depending upon the soundtrack used, provision is made to by-pass either the magnetic or optical head, thus saving wear on the film-handling parts.

There is a curved gate and trap unit: focus is improved, center-to-side focus is maintained, and film buckling drastically reduced. Steel runners covered with Tenflon hold the film against the gate curve. Runner tension is maintained automatically by a self-tensioning device. For film running at higher speed, readjustment of tension is immediate by means of an adjusting screw.

The lens mount, accommodating any focal-length lens for 70- or 35-mm film, enables an immediate change of lens. Adapters and fittings are available for all lenses and all combinations of lenses and anamorphic attachments: proper lens systems may be prepared in advance and inserted, in focus, within seconds. Focusing is done by an extremely fine micrometer adjustment.

Driving Means, Lubrication

The drive motor is direct-connected to the projector mechanism through a resilient coupling. Temperature variations, or line voltage fluctuations, have no effect on the constant-speed characteristics of this synchronous motor. A system of variable gearing enables the frame speed of the mechanism to be changed from 24 frames per second to 30 frames per second when necessary. The change is made by loosening two quick-lock levers and moving the motor toward or away from the mechanism.

An automatic circulatory lubricating system is employed. Excepting regular oil changes, no special lubrication is required. A fine-mesh filter continuously cleans the lubricant.

Cone-Type Shutter Used

The Seventy uses a cone-type shutter with the blade cutting the light beam directly behind the aperture plate where

the beam is smallest in diameter and the cutoff most efficient.

The large reels for 70-mm film and also those for handling more than 2000 feet of 35-mm film are very heavy and require special takeup handling. The Seventy utilizes a motor-driven takeup having a load-dependent friction unit to control tension. Constant even pull of the film is assured because the amount of takeup coupling is determined by the weight of the reel itself. The initial inertia of the reel is overcome by a unique feature of the takeup motor in combination with a film-tension switch.

Is a 20-Degree Angle Enough?

The pedestal is extremely rugged and completely enclosed. Provision is made for an upward tilt for drive-in theatres and a downward tilt of 20° for indoor theatres. All electrical controls are prewired so that it is only necessary to bring in the normal number of a.c. circuits. Levelling devices compensate for uneven floor surfaces.

The lamphouse table accommodates any make of reflector or condenser arclamp. The lamp may be moved toward or away from the mechanism, each corner of the lamphouse base may be moved up or down, and the entire lamphouse may be moved sideways, thereby providing for a very accurate alignment of the optical centers of the arclamp and the projector mechanism and the proper working distance of the reflector or condenser used.

Some Other Features

The lower film loop can be increased or decreased during operation so that film noise is minimized. Should framing be necessary due to an incorrectly made splice or to improper threading, the loop size can be conveniently altered. A centrifugally-controlled fire shutter is provided which automatically closes when the mechanism slows down to a predetermined speed, thus shielding the film from undesirable arclamp exposure.

Projector cooling is assured by two separate means. A large ventilator fan on the drive shaft of the projector motor provides constant ventilation to the rear of the mechanism; also, a compressed air blower is furnished to provide a stream of air on the film. This pressurized air is directed on both sides of the film through four jets located at the aperture, thus preventing excessive heating of the film-handling parts.

OBITUARIES

WM. G. STUBER: 1864-1959

William G. Stuber, who succeeded founder George Eastman as president of Eastman Kodak Company, died on June 17. His age was 95.

Mere words just won't serve to convey any proper appreciation of the contributions of William Stuber to the photographic field—they could be strung out interminably and still fall far short of doing justice to the man who, setting out on his chosen field of endeavor as an obscure photographer in Louisville, Kentucky, attained world-wide fame as an self-made expert in photographic emulsion-making. He is credited with devising, on his own and by dint of unswerving devotion to his craft, those methods which achieved the uniformity and reliability for which Kodak films, plates and papers are justly renowned thoughout the world.

Eastman's Logical Successor

George Eastman once remarked that Stuber possessed "a more profound knowledge of photography than any other person.

Mr. Stuber joined Kodak in 1894 as an expert in photographic emulsion-making and served the Company in an active capacity for 47 years. He retired as Chairman of the Board of Eastman Kodak in 1941.

[EDITOR'S NOTE: There exists a biography of Mr. Stuber, written by his wife, Mrs. Rose Stuber, of which only two copies were printed. IP has a transcript, in part, of this intensely human document, and in the near future will in its wholly inadequate but none the less sincere way pay suitable tribute to this pioneer in the photographic field.]

GEORGE CARRINGTON—Altec

George L. Carrington, chairman of the board and chief executive officer of Altec Companies, Inc. (formerly Altec Service Co.) and Altec Lansing, was fatally stricken on June 19 last. He was a pioneer sound-picture man while with Electrical Research Products and, additionally, made many personal contributions to the advancement of the art.

Always a close co-worker with and sincere advocate for the welfare of projectionists ("in whose hands this whole thing lies," to quote him verbatim) George Carrington was respected and will be missed by the craft the interests of which he did so much to advance.

B. F. HOLMES, Toledo L. U. 228

Belmont F. Holmes, charter member of Toledo L. U. 228, suffered a fatal heart attack on May 28 while at work in the projection room of the Rivoli Theatre in that city. He and three other men organized the Local 47 years ago.

Treasurer of the Local for many years, Holmes also served as business representative for Ushers and Cashiers Local B109. Just prior to his death Local 228 tendered him a gold life membership card.

L. CLARK, Rochester L. U. 253

Laurens Clark, lifetime member of Rochester, N. Y., Local 199, died suddenly recently. He was 71 years of age. Two months ago he retired from his long-time post as projectionist at Loew's Theatre. He was an active member of Orpheus Lodge No. 1082, F. & A. M. He is survived by his wife, a daughter and two sons.

Shades of Edison

To the Editor of IP:

I have a 1907 Edison projector in good working condition. Is there anybody who would be interested in acquiring this?

If there be any of your readers who have a collection of historic projection machines or any of the artifacts connected with the film industry, I should like to hear from them. There may be some who have duplicate items for exchange or they may wish to trade for something closer to that which they are collecting or, perhaps, for outright sale of all or parts of the collection.

All letters of inquiry will be answered promptly whether they relate to artifacts or old magazines or books on motion pictures, including fan magazines, film trade journals, etc.

Chet S. Switell
2946 Watseka Ave., Los Angeles, Calif.

[Our curator in such matters is Ray Brian, 812 West Maywood, Peoria, Illinois, who has devoted 40 years to research into and collection of projection memorablia. Another such enthusiast is James Card, curator for Eastman House, Rochester, N.Y.]

Electronic device so small that 100 million might be put into one cubic foot is under research by RCA. Work is part of program to develop far more compact logic circuits, the basic building blocks of electronic computors, via integrated-electronics methods (integrated unit is complete set of circuit functions built into one, extremely small piece of solid material such as silicon).

In various arrangements, logic circuits calculate, sort, remember, and control computer's information flow. Ideal of designers is human brain: its basic components, neurons, are so small that more than 100 million could be put into one cubic foot.

Zeiss-Ikon Automatic Ernemat Projector

By H. TŪMMEL, Zeiss-Ikon AG. Werk, Kiel, Germany

NOT GENERALLY KNOWN to projection people in the United States and Canada (much less to our good neighbors in South America) is the degree to which automation has been applied to the projection process in Europe.

Zeiss-Ikon, of world fame in the field of visual and aural projection, has been devoting a major portion of its vast technical resources to a solution of this intricate problem for at least the past ten years—and IP has been kept informed step-by-step (since 1948) of their progress in this direction.

Well, except for the loading of the film and its threading through the projector, they have finally done it! These never-say-die technologists tell us in unmistakable language in the taut paragraphs and illustrations appended hereto just *what* they do and *how* they do it. They not only include the complete projection-room operation but they also provide for *remote* control of *both* picture and sound, including the volume level—from any point in the auditorium or in the manager's office.

You think that this is all? They also provide for an *automatic* connection to the "what's playing" sign either *outside* the theatre or *inside* the lobby and they state the *exact* time in lights that the next complete show goes on!

It is emphasized that the striking and subsequent control of the projection light source relates to the Xenon lamp (cold) which approximates the results obtainable, spectrally and in light intensity, with a low-intensity carbon arc of the 60-65 ampere-range. Be not unaware, however, that these same Z-I personnel are now working assiduously with a similar automatic control for high-amperage carbon arcs, not to mention the Philips SPP non-shutter projector using the SPP discharge lamp. (IP for November 1958, p. 8.)

These data are presented here not to engender any feeling of futility on the part of our valiant craftsmen (the good genie will shield us—*maybe)* but merely to keep all of us informed.—J. J. F.

ZEISS-IKON has described previously in its technical bulletins ("Picture and Sound") the underlying principle and theory of operation of its automatic projector—now known as the ERNEMAT. It now happens that the ERNEMAT has been installed in a large number of theatres on the European Continent and is operating, we and our clients think, to perfection.

We are happy to know that INTERNATIONAL PROJECTIONIST, ever on the alert for advances in the art, whatever their source, will be the first to publish exclusively these data. It has earned this privilege by being ever vigilant for the new and the novel in the visual-aural art.

The ERNEMAT has the great advantage of being extremely versatile in that it is capable of controlling an extraordinary number of operations without being designed for any specific number of performances.

Minimum of 24 Circuits

Normally, the ERNEMAT is supplied to operate 24 electrical circuits. If necessary, however, the ERNEMAT can be equipped with an additional 24 circuits so that a very large number of operations can be controlled by it.

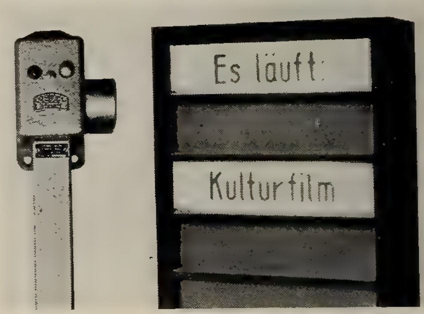


FIGURE 2

Four-chord gong (left) and program indicator (right), both automatically operated.

The actual control of the projectors (ED.'S NOTE: mark well the plural "projectors") consists of starting, changing-over, stopping, igniting the lamps, the operation of additional various theatre features: the curtain, the footlights and the masks for the screen margins (standard 1/1.37; CinemaScope 1/2.35), the lights in the auditorium, and the operating of the mode-of-operation switch of the amplifier (record player, optical sound, magnetic sound and gong), and switching of the illumination of the foyer (if need be, several circuits).

Other Automatic Applications

The principle of such an arrangement is shown in Fig. 1.

The ERNEMAT, furthermore, will also

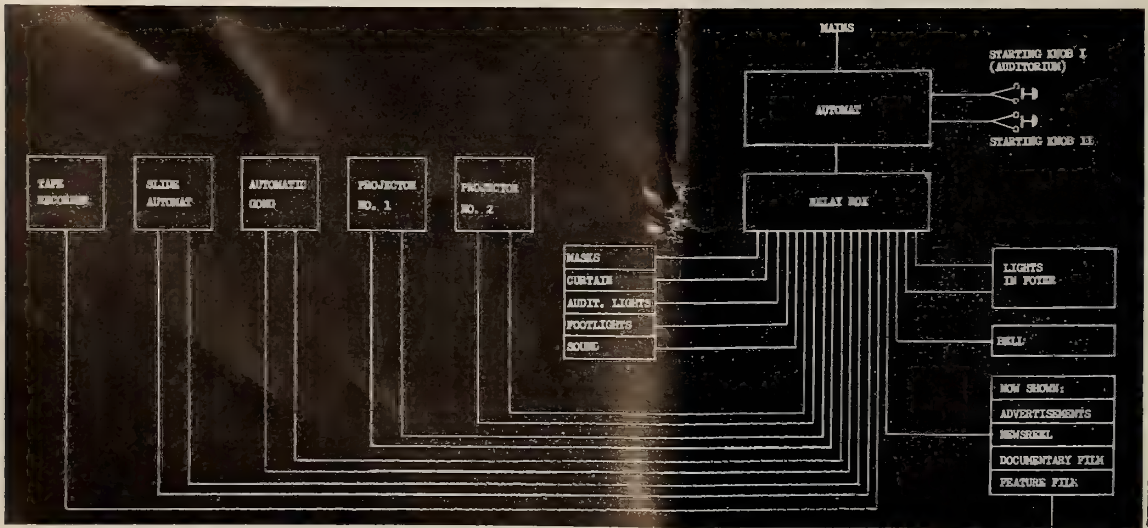


FIGURE 1

Diagrammatic representation of connections for the various devices which make for automatic operation.

operate an automatic slide projector and the automatic four-chord gong (Fig. 2). At the same time the program-indicator box (Fig. 2), which is often installed in the foyer to indicate the film being shown. can be connected to the ERNEMAT which will operate the box so that the onlookers outside the theatre can see at a glance whether slides, or the documentary film or the main feature attraction or the newsreel is showing at the moment.

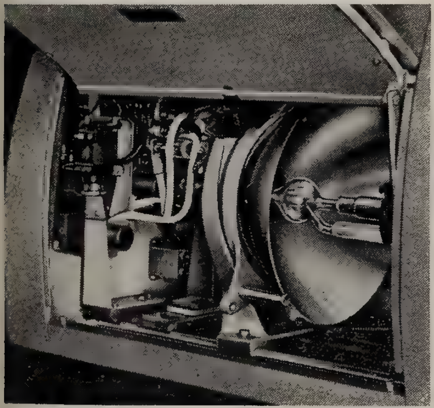
It is also possible to connect a bell to the ERNEMAT which rings and alerts the staff shortly before the end of the performance so that the cloakroom attendants and the doorkeepers are prepared for the rush of the people leaving the cinema. Quite a number of further connections to the projection automatic can be made in accordance with local conditions, so that the functioning of all these items need no longer be controlled manually.

[See item relative to new light units which follows immediately.]

THE XENON LAMP

Two new items of lighting equipment for 35-mm projection, both with specially designed optical systems, are offered by the G. B.-Kalee Division of Rank Precision Industries, Ltd. They are the Xenon lamp and the incandescent bulb lighting unit.

The Xenon lamp is push-button controlled and needs no adjustments throughout its life. Lighting is instantaneous and the striking circuit automatically disconnects itself immediately the main arc strikes. Maximum light collection is obtained by the single deep mirror, 12" in diameter, operated in a horizontal position. This system ensures a symmetrical light distribution better than the British Standard specification of 60% minimum ratio of side-to-centre luminance.



Close-up view of Xenon projection lamp.

G. K. "Inkie" Bulb Unit

The incandescent bulb unit, for use with the G. K. 37 projector, is for small-screen locations where the Xenon or con-

ventional carbon arc would provide too much light. Optics comprise a spherical concave mirror, mounted on an adjustable holder behind the lamp, with a 3-element condenser system in front. The condenser system consists of two meniscus lenses and one double-convex lens.

The monoplane lamp, 900 watt (30 volt, 30 amp.) with pre-focus cap is fitted in a hinged lamp holder which swings outward for easy cleaning and quick lamp replacement.

Lorraine's New 70/35 Carbon

Lorraine Carbons cites reports from its roving representatives throughout the United States as proof of the complete success achieved by its 13.6-mm Special carbon designed expressly for the new 70/35-mm projectors. This success is attributed to the original large-core construction of the entire Lorraine "Orlux" line of carbons.

Constant intensity, uniform brilliance over the entire screen area with consistent color temperature balance, a slow burning rate and low current requirements are cited by Lorraine as special features of this carbon. The Special comes in lengths of 18, 20 and 22 inches. Test samples and price list available from Carbons, Inc., Boonton, New Jersey.

Free Preparatory Time Nixed

Projectionist Local 199 of Detroit will no longer give 15 minutes of unpaid preparatory time to theatres. D. F. Erskine, Union prexy, said that for some years theatres have been scheduling the full contract time as screen time with the picture actually running—"on the projectionist's time." No more, says Erskine.

Theatres will now have to reschedule their shows to include the 15 minutes within the contract terms or pay overtime. New rule applies to all theatres except drive-ins and The Music Hall, latter playing Cinerama, which have special pacts. The new rule is being accepted by all exhibitors without substantial objection.

25-30 Club 20th Anniversary

The 25-30 Club, organization of veteran projectionists with members throughout the world, will observe its 20th anniversary with a dinner-dance at the Hotel Empire, New York City, on Nov. 5 next. Incident to the party the Club will publish a Journal which will review its accomplishments and reflect its aspirations.

For tickets and ad space in the Journal address Secretary Morris J. Klapholz, 125 West Tremont Ave., New York City 53.

Pay-TV for Toronto, Canada, This Fall

70 Miles of Cable For Service to 13,000 Homes

BELL TELEPHONE OF CANADA will install 70 miles of TV cable to permit Trans-Canada Telemeter, a division of Famous Players Canadian Corp. to inaugurate pay-TV in Toronto's westward suburb of Etobicoke this Fall or early Winter. Paramount Pictures, of New York, has a 51% interest in Famous Players.

Famous states that "at least" 5000 homes units will be installed by mid-Winter, although "double that number is a distinct possibility." Potential of the first 70 miles of cable was given as 13,000 homes, but Famous says Telemeter will be readily expandable to serve 40,000 homes in the Etobicoke area.

What System Will Offer

There will be no charge to the consumer for the Telemeter unit other than "a nominal fee of $5, comparable to a telephone connection charge." Varying prices (coin in slot at time of viewing) will be charged for different programs.

The Telemeter system will add three program channels to any conventional black-and-white or color TV set. In West Toronto, homes equipped will be able to receive not only the five regular broadcast channels—Channels 2, 4 and 7 from Buffalo; Channel 6 from Toronto and Channel 11 from Hamilton — but they will also be able to watch Telemeter's three program channels via Channel 5 on their TV receivers. These additional channels are then selected on the Telemeter unit by turning the dial to Channels A, B, or C.

Basic Telemeter programming at first will consist of "latest and best motion picture features, with blacked-out sports to be added later." In addition, "long-range plans are afoot to bring outstanding dramatic and cultural attractions into Etobicoke, plus important innovations in educational TV and a wide variety of events of local importance that will be offered free as a public service."

First-Run Feature Angle

Close observers see in these words more than meets the eye, pointing to a statement by President Barney Balaban of Paramount pictures at the last stockholders' meeting, to wit: "Paramount will consider the market in each situation and what the new medium can produce for us as revenue. We will consider the new medium as though any customer came . . . and asked for our pictures." Plain enough?

Famous players, with 376 theatres in 10 provinces in Canada, also laid it right on the line, as follows: "We feel that we are in the business of exhibiting motion pictures *regardless* of the medium through which they are exhibited."

Etobicoke Township, part of Metropolitan Toronto, was chosen because of density of population—122,000 people in 43 square miles—and the highest per capita income. Cost of this first Telemeter project, including a broadcast studio soon to be erected is estimated at $1¼ million.

Payoff line in Famous' announcement: "We will . . . organize companies in various Canadian communities. We hope that exhibitors will participate *with us* at the local level."

You Think He's Kidding?

"I feel it incumbent upon me to advise you that due to the recently-discovered non-homogeneous structure of No. 2 anamorphic unit tending to be incommodious at this time, you rapidly revise your schedule regarding the second feature. This, I feel, is not inconsistent with conditions prevailing at this time."

Ed. McCormack, Local 582, Brantford, Ont., Canada

Ten-Arclamp Brochure? Write Strong Electric

Just for the asking (a postcard will do) anybody seriously interested in the projection process may have a beautifully-illustrated brochure which sets forth in concise language the data anent *no* less than 10 projection arclamps—for *Specific* situations.

Address Strong Electric Corp., 31 City Park Ave., Toledo 1, Ohio.

VIDEOTAPE RECORDER

(*Continued from page* 11)

ent only on the frequency of deviation, so we have essentially recreated the original amplitude modulated signal.

Head Switching During Reproduce

Switching, during the reproduce mode, occurs immediately after pre-amplification of the head outputs and before the demodulation process. Multi-grid gating tubes are employed in circuits which require a coincidence of two positive pulses to trigger each of the four gates consecutively. Each gate acts as an individual switch for its respective head.

All control pulses are derived from the photoelectric cell, whose output phase is directly related to the angular position of the head drum. Two pulses are required to actuate the switching tube—a gating pulse on grid 1 and a switching pulse on grid 3. The gating pulses are 240-cycle trapezoidal waves, with the pulse to each tube shifted 90° in respect to the next. The video signal rides on these gating pulses. The actual switching time is determined by positive 480-cycle square wave switching pulses (with extremely fast rise-and-fall times).

Forming the Integrated Signal

These pulses are formed by doubling, amplifying, and clipping the output of the photoelectric cell. The resultant square waves are fed to a phase-splitting circuit which delivers in-phase pulses to gates 1 and 2, and pulses shifted 180° to gates 3 and 4. Only the tube at which the two pulses occur simultaneously is able to conduct and thus pass the video signal. The output of all four gates are combined to form an integrated signal.

The Blanking Switcher controls the exact time of switching so that it occurs during horizontal blanking. It does this by utilizing a 480-cycle multivibrator which is controlled jointly by the 480-cycle signal from the photoelectric cell and the synchronizing pulses in the demodulated video signal. The multivibrator frequency can be varied so that the exact moment when the switching pulse is delivered to the gating tubes coincides with the desired point in the video signal.

Processing Amplifier

If the output of the Videotape Recorder were to be viewed only on local monitors and not fed to network facilities, there would be no need for the Processing Amplifier. However, if we used the unprocessed output for transmission, the unavoidable transient noise—resulting from dropouts, switching transients, brushes, etc — would upset the stabilizing amplifiers and sync tip clampers employed.

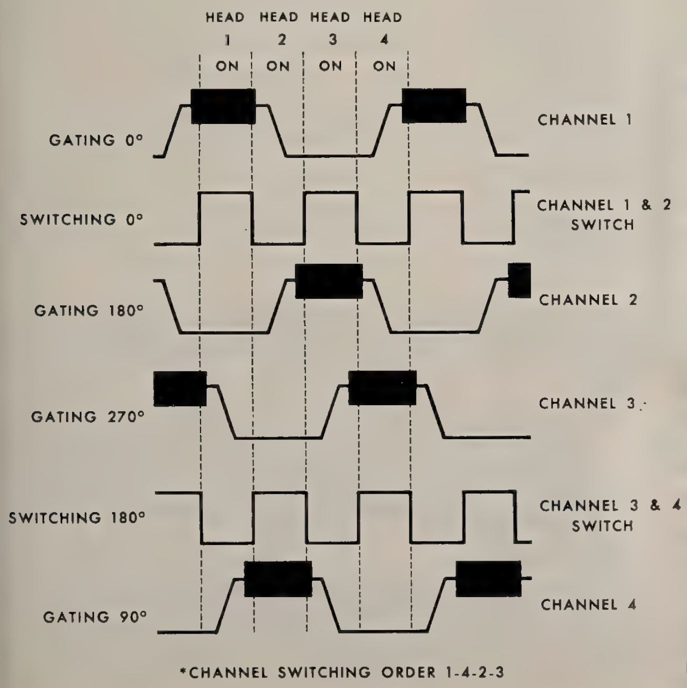
Stabilizing amplifiers clamp the picture at blanking level at the trailing edge of any pulse that enters the sync region. A noise pulse in this region would therefore result in abnormal shading of the picture. Sometimes the sync circuits in the stabilizing amplifier would be so confused that whole patches of sync pulses might be missing.

Briefly then, the Processing Amplifier has two major circuits—the synchronizing information is stripped off the video and both then continue in separate paths. All noise on the sync pulses is removed by a limiting action, and new blanking pulses are generated. The reconstituted sync information is then reunited with the video to provide an improved composite signal.

Restoring the "Composite" Setup

The relative level of the video and sync signals may be varied so that the reference black level in the picture can be separated from the blanking level of the sync information (using television jargon, this is referred to as restoring "setup" to the composite signal).

[NOTE: The final article in this series will describe the servo control systems, editing and splicing procedures, and duplicating tapes.]



Illustrating the action of the gating and switching pulses in selecting the output of one head during the reproduce mode. Note that the phasing of the waveforms is such that the gating and switching pulses simultaneously go positive at only *one* channel at a time. The video signal is represented by the black blocks on the gating waveforms.

N. Y. State Assoc. Meeting

The 1959 Spring Meeting of the N. Y. State Association of Projectionists was held in Hornell, N. Y. on May 25 last. Discussions of craft problems were supplemented by an excellent technical program and various social activities. Among those present were:

Francis E. Larham, Association prexy; Charles Wheeler, secretary; Bill Ingram, educational committee chairman; James Brennan, 1st vice-president of the IA; H. Paul Shay, 10th District secretary-treasurer; William Spooner, Lorraine Carbons, and George Raaflaub, Syracuse Local 376.

Fine Technical Program

Stars of the technical program were Dr. Frederick Kolb, of Eastman Kodak Co., and Larry Davee, president of Century Projector Corp. Dr. Kolb's paper bore the unlikely title "Weather in the Projection Room," but this tag is beautifully non-descriptive of the wealth of technical data it contained. Davee discussed in detail the new Century 35- and 70-mm projectors, with emphasis on the latter.

International Projectionist was endorsed as the official technical magazine of the association.

Hornell Local 676 as host gave a buffet spread in the late afternoon and a steak dinner at 11.30 p. m.—hospitality par excellence.

LETTERS TO THE EDITOR

Erratic Sound; Lens Types

To the Editor of IP:

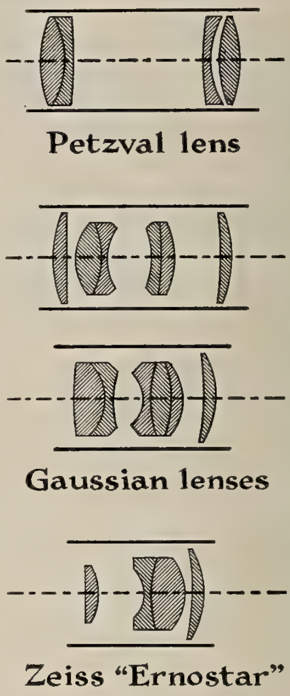
We recently played two Paramount reissue prints, "A Place in the Sun" and "Shane," both of which were made some years ago and both of which had a single variable-density sound track. The sound on these prints was very erratic—anywhere from 8 to 10 db difference in speech that made it impossible to establish and keep a given level. Gunshots sounded like cannon shots.

The recording was by Western Electric. We have Simplex X-L soundheads and an RCA amplifier. Could you advance any reason for this variance in the sound?

In the article on lenses in IP for May mention is made of "Petzval-type" lenses. We are using two quite old 6-inch prime lenses for our CinemaScope showings. One lens is coated, the other is not. Could these lenses be Petzvals? Is there some way to identify them?

Oliver G. Brewer

Starkville, Mississippi



Here in cross-section are shown the three classic types of projection lenses. The Petzval-type lost favor because of its great curvature of field, although later-day coated Petzval lenses give good results when their focal length is 5½ or 6 inches.

While photographic density, or "gamma," is very much more critical in the processing of variable-density soundtracks than it is in the processing of variable-area tracks, the film laboratories take such care with the developing and printing of sound negatives that other causes of the erratic sound levels must be suspected.

All the original soundtracks made during the shooting of a picture must be re-recorded on a "master track" for the purpose of controlling sound volume, introducing background music and sound effects, etc. While this is a job for experts, the results often suggest that the sound mixer was suffering from a severe hangover.

Some members of the Hollywood sound clique are secret admirers of "peaky" English speech, while others vainly imagine that they are making a film "dramatic" by boosting gunshots and other elemental noises to ear-spliting, nerve-shattering levels. And all too many "recordists" ignore the fact that a theatre auditorium is somewhat noisier than a plush Hollywood preview room, making speech difficult to understand when it is mumbled and whispered in Pasadena Playhouse diction.

"Dropouts" in Sound Tracks

"Dropouts" in magnetic originals and masters are another cause of fluctuating sound levels. All the defects of magnetic originals are, of course, transferred to the re-recorded optical-track negatives

used for making the release prints. In the early days of magnetic recording by the film studios, tape was not as good as it is now, nor was it handled with such great care. So in addition to dropouts caused by tape defects, dropouts caused by improper erasing, biasing, and storage added to the troubles introduced by the new medium.

Magnetic recording has several undeniable advantages. It has a lower noise level than any other medium, permitting several stages of re-recording without sound deterioration, it is capable of high-fidelity sound quality, it is cheap, and it makes possible immediate playbacks without the expense and delay of film processing.

Optical sound, however, is undeniably preferable for single-channel release prints; and meticulously made variable-area optical tracks have a sound quality as high (if not higher) than that of magnetic tracks. The only flaw of the optical track is its somewhat higher noise level, for a bad magnetic track (and some of them are extremely bad) sounds worse than anything this side of an Edison cylinder record.

Gauss- and Petzval-Type Lenses

Gauss-type projection lenses have superseded the older Petzval-type objectives because the latter are afflicted with such a great degree of field curvature that they are unable to image properly light rays entering or leaving the lens at angles greater than 10 or 15 degrees. This means that the sides and corners of the picture are considerably blurred when the middle is sharply focused. In an attempt to reduce field curvature, focus was compromised by certain makers of Petzval lenses; but this expedient decreased resolution all over the screen.

It is easy to tell a Petzval lens. It has only two achromatic elements, front and rear (4 separate glass lenses in all, 2 of which are usually cemented together). A Gaussian lens has three or four elements, some of which are single while others are doublets. The accompanying diagram shows Petzval and Gaussian lenses in cross-section.

Petzval lenses still are made by most American manufacturers although they went out of style years ago in Europe. The Germans, in fact, originated both types, as well as certain new designs not yet manufactured in America. The newer lenses have been made possible by the production of new kinds of optical glass possessing unusual light-bending properties.

High-grade coated Petzval lenses give very satisfactory results when their focal length is greater than 5½ or 6 inches, and when their optical speed is

not greater than F:1.9 or F:2.0. When greater speeds and shorter focal lengths are needed, only such new-style Gaussian lenses as Bausch & Lomb Super Cinephors and Kollmorgan Super Snaplites can give the desired high-contrast characteristics and corner-to-corner image sharpness.

Obtaining Better Results With Glass Slides

Cardboard-mounted 2″ x 2″ slides are not only exposed to damage of the picture area by moisture and scratching, but have a pronounced tendency to buckle out of focus in the projector. Valuable 2″ x 2″ slides should therefore be mounted between thin cover glasses for protection and more satisfactory projection.

It should first be determined, however, if the slide projector which is used is capable of accepting the thicker glass-enclosed slides without jamming. The extra thickness contributed by the binding tape causes trouble in certain magazine-loaded projectors.

TV's Voracious Film Appetite

Feature films, including old Hollywood product and foreign pictures, now occupy from 1/4 to 1/3 of all TV viewing time in major U. S. markets, according to a survey by *TV Guide*. In the Los Angeles and San Francisco areas, states the survey, viewers can see about 190 movies weekly; in New York, 147; in Cleveland, 135; in Seattle, 90, and in Chicago, 60.

Variable, All-Ratio Screen

Variable curvature of a permanent screen installation has been achieved in the Columbia Theatre, London, England, by means of the installation therein of a Perlux screen, 36 feet wide and 17 feet high by Andrew Smith Harkness, Ltd., a subsidiary of Rank Precision Industries Group.

For CinemaScope and other widescreen presentations, the depth of curve is 2 feet. This is adjustable through *all* ratios to a maximum of 6 feet for Todd-AO presentations. The mobile Harkness loudspeaker towers move in unison with the screen when the curve is altered. The top and side masking is electrically-controlled from the projection room in order to attain all ratios from "normal" to Todd-AO.

SCREEN-LIGHT REQUIREMENTS

(*Continued from page 7*)

whether the center of the film aperture, the lamphouse light-cone, the positive-carbon holder, and the center of the mirror all lie on the same line. If they do, the lamp and mechanism are in line.

Proper Arc Focus

The optical function of a lamp mirror is to collect the light falling upon it from the positive-carbon crater and focus it down to a reasonably small "spot" of intense illumination upon the film aperture. The "spot" focused upon the aperture is actually an image of the positive crater with its luminescent ball of white-hot gas. The size of this image must be great enough to cover the aperture completely, and so must be more than 1 inch in diameter to give good coverage over a 35-mm aperture of any aspect ratio. Too large a spot, on the other hand, wastes light and overheats the projector head.

Because the image of the crater must be nearly in focus at the aperture, the entire arc must be moved forward or backward to focus it for maximum uniform illumination on the screen. The arc-focus adjustment is best made by projecting blank light upon the screen with the shutter running to minimize heating of the lens.

The arc is struck, the carbons separated to the recommended gap distance (about ¼" for Suprex trims; ⅜"—½" for 9-, 10-, and 11-mm rotating-positive trims; ½"—¾" for 13.6-mm mirror-arc trims, and ½" for 10-mm Hitex and Ultrex "blown" arc trims), and the carbons allowed to "burn in" until a good crater is formed.

The projector is switched on, the lamphouse douser opened, and the arc moved slowly forward and back until the point is found where the screen light is brightest, whitest, and reasonably uniform without excessive fadeaway toward the edges of the screen. The arc-indicator card is then adjusted and secured in place to conform to this position of the arc.

In testing the arc focus you will notice that the screen light becomes yellower and dimmer when the arc is moved too far toward the mirror. The yellowish shell light of the positive carbon, not the bright gas ball in the crater, is then being focused upon the aperture. Also, if the arc is moved too far away from the mirror, the light again loses brightness, but assumes a bluish cast. In this case the blue light of the arc stream is being brought into focus. The light is white *only* when the gas ball in the crater is in focus.

If the arc is brought a trifle closer to the mirror than the average-focus position, the most uniform, but not the brightest, white light will be obtained. If, on the other hand, the arc is moved a trifle farther away from the mirror, the result will be maximum white light with more or less fadeaway toward the edges of the screen. Side-to-center illumination distributions of 60%—80% are considered satisfactory, and are provided by most modern lamps.

Whether the arcs are focused for maximum distribution or maximum light depends upon local conditions and the preferences of the propectionists. Most drive-in projectionists find it advantageous to focus for maximum light regardless of any slight "hot spot" that may be obtained. Indoor theatres, unless their screens be so large that they are literally "starved for lumens," require more even illumination of the picture for greater realism.

Light Equalization

Needless to remind the reader, the vertical and lateral mirror-adjustment knobs should be used to center the "spot" on the aperture at the outset of the arc-focus test. It will be found by experience that modern rotating-positive lamps hold the spot position extremely well, and do not require the frequent "tinkering" which is sometimes necessary with simplified H-I lamps. Crooked positives burned in Suprex lamps often throw the spot up or down or to one side of the aperture, and result in discolorations of the screen light at the sides or corners. These defects should be corrected the moment they occur during projection by adjusting the two mirror knobs.

Modern rotating-positive mirror lamps seldom give trouble because of the short carbon protrusion beyond the positive feed assembly. These lamps can even burn crooked carbons without causing undue difficulties! A few modern lamps burning rotating-positive trims have a burner adjustment which takes the place of vertical and lateral mirror-tilt controls. Once adjusted for optimum performance, these lamps very rarely require optical readjustment.

When the lamps on both projectors have been lined up and adjusted for maximum performance, a screen-light test should be conducted with both lamps on, both projectors running (without film), and the changeover shutter operated to switch the light from one machine to the other several times.

If the field of light on the screen

Not One Fluff in Fight C-C

More important to IP than the estimated gross of more than $1,050,000 from an audience of about 245,000 for the Ingemar Johansson-Floyd Patterson heavyweight bout is the fact that in the 170 closed-circuit theatres there was not a single technical failure. This is at once a tribute to closed-circuit TV's growing importance and to the technical personnel behind it.

from one of the projectors appears dimmer or of a different color, recheck the arc-gap distance, the current, and the arc focus on the lamp of lesser brilliancy. This failing to equalize the fields, and it is certain that the shutter transmissions of the two machines are the same, it may be necessary to increase or decrease the working distance of one of the lamp mirrors by a small amount (preferably by not more than ½ inch either way).

It is futile to strive for perfect light equalization if a temporary "loaner" lens of a different make or speed is being used in one of the projectors.

A light-intensity difference of about 5% is the smallest that can ordinarily be detected visually by flashing alternate fields on the screen in rapid succession. This is the difference between 14 and 13.3 foot-lamberts, between 12 and 11.4, or between 10 and 9.5. Brightness differences of this small order may occur spontaneously and in sporadic fashion because of slight differences in carbons and arc focus, and because of obscure minor variations in arc current.

In the unusual case of light differences too great to be eradicated by a slight readjustment of working distance in one lamp, and there is reason to suspect the quality of the mirror, verify or disprove your suspicions by swapping mirrors. The practice of using an old mirror in one lamp and a new one in the other lamp is to be condemned. When one mirror is replaced because of breakage, the other mirror ought to be replaced, too. Save the old good mirror for a spare. However, the reflective powers of old mirrors may be checked against those of new mirrors by light-meter tests at the screen. The same projector should be used for testing both mirrors.

Projection Light Measurement

With everything in satisfactory working order, the exact value of the light intensity at the screen (foot-candles) may be measured directly with a light meter corrected by a suitable filter to match the visual sensitivity of the eye. The procedure given in National Projector Carbon Bulletin No. 3 should be followed and the blanks filled out. From the data so obtained, the number of screen lumens from each projector both with and without the shutter running may be calculated.

$$\text{Lumens} = \text{Screen Area} \times \text{Foot-Candles}$$

$$\text{Lumens} = \frac{\text{Screen Area} \times \text{Foot-Lamberts}}{\text{Screen Reflectance}}$$

Projection illumination should be measured both with and without the port glasses in place. The transmittance of the port glass may be computed by dividing the light *with* the glass (lumens, foot-lamberts, or foot-candles) by the light *without* the glass. This should be somewhere between 88% and 92%, a 10% port-glass light loss being about average for clean, high-grade optical plate.

A great deal of careful thought should be applied to the matter of adequate lamphouse ventilation when new lamps are installed. The larger lamps are equipped with blowers to cool the lamphouse and mirror, and "blown" arclamps depend for satisfactory operation upon a stream of air directed upon the arc from jets arranged concentrically around the positive carbon. The air stream constricts the luminescent gases of the arc and greatly increases their brilliance.

Requisite Air Velocity

It is recommended that vent pipes fully 8 inches be used. The upper stack blower aids the lamphouse blowers in the removal of exhaust gases from the arcs. The stack blower should produce an air velocity of between 500 and 1000 lineal feet per minute as measured by a Velometer or similar device. The lamp chimneys may be connected directly to a vent-pipe system having "check drafts" and bypass dampers, or else a hood of ample size should be positioned over, and as close as possible to, each lamp chimney.

The bypass system is recommended for "blown" arc installations. The bypass openings should be opened a little at a time, if necessary, until any unsteadiness of the arc, caused by fluctuating drafts, is eliminated. *Reduce the air-flow from "blown" arclamps by use of the bypasses only. Do not attempt to reduce the air-flow by using either dampers in the 8-inch pipe or smaller pipe.*

The water for cooled positive-burner heads is usually supplied by recirculating systems made by the manufacturer of the lamps. The advantages of a recirculator over a tap-water supply are many. Distilled water free from deposit-forming calcium compounds and corrosive chlorine may be used in a recirculator, and special lubricants may be added for proper lubrication of the internal parts of the recirculator. The manufacturer's recommendations should be followed anent the use of antifreeze compounds.

[CONCLUSION]

INTERNATIONAL PROJECTIONIST

AUGUST • 1959

VOLUME 34 • NUMBER 8

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• Quality of Film and TV Images — by Robert A. Mitchell •

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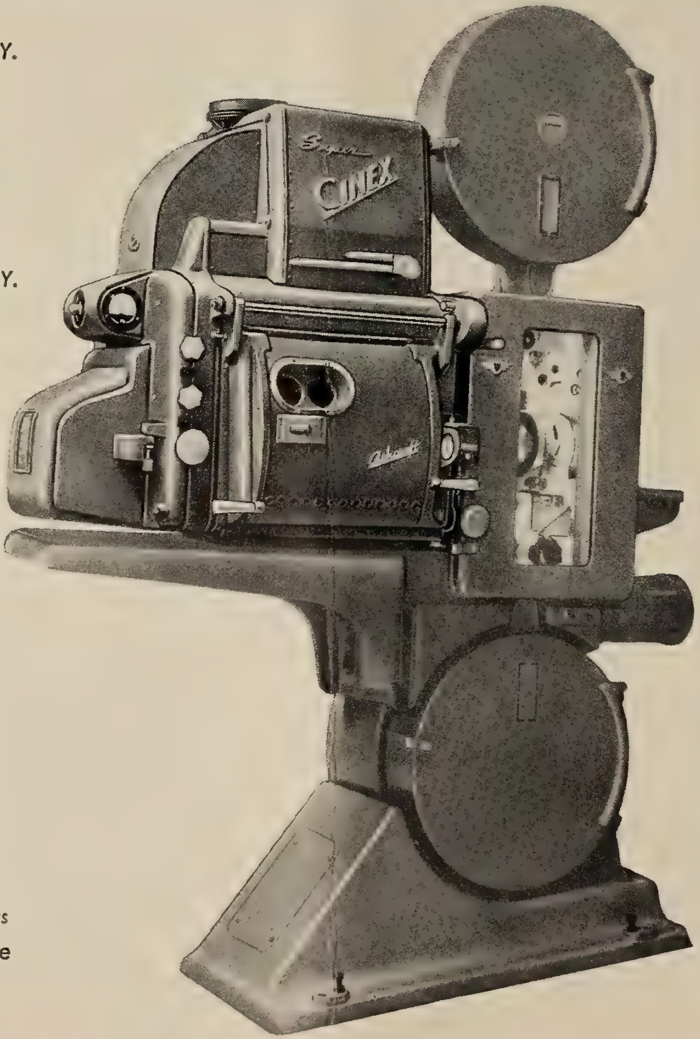

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TOWER Theatre — *Corpus Christi, Texas*
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Monthly Chat

Sound Volume Control in the Theatre

SAMUEL GOLDWYN has made a magnificent visual replica of the famed stage play "Porgy and Bess," now being roadshown. It is not a motion picture; it's a set piece, a static presentation in Todd-AO 70-mm that reflects the inability of anybody to inject motion and realism into any wide-screen picture. As such, however, it's a stunning *tour de force* in gorgeous color, a visual delight.

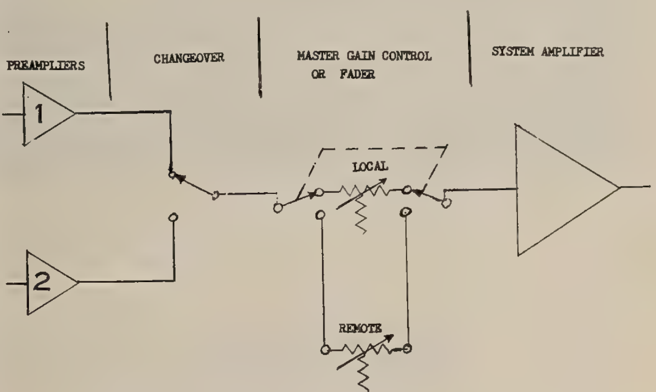
Several New York critics in their reviews of "Porgy" observed that the over-all effect was spoiled by excessive sound volume level; they added that it was "lamentable that the inefficiency of the projection crew should be permitted to spoil this chromatic masterpiece." The critics are dead right on the score of excessive volume; but they're wrong as hell on faulting the projection crew. *Volume control is not now and properly never has been the function of projectionists.*

Mr. Sidney Deneau, vice-president of Paramount Distributing Corp., after "studying theatre operating problems over a period of months in the field," opines that sound volume control is the most serious projection problem. Says he:

Solution to Problem Already Solved

"Exhibitors and service companies should be partners in solving the sound regulation problem. If both talked the problem out, engineers in short order would come up with the right system."

This observation is typical of the profound ignorance of exhibitors and distributors anent the projection process. There is no theatre sound volume control problem; it was solved 25 years ago. The accompanying rough sketch shows how

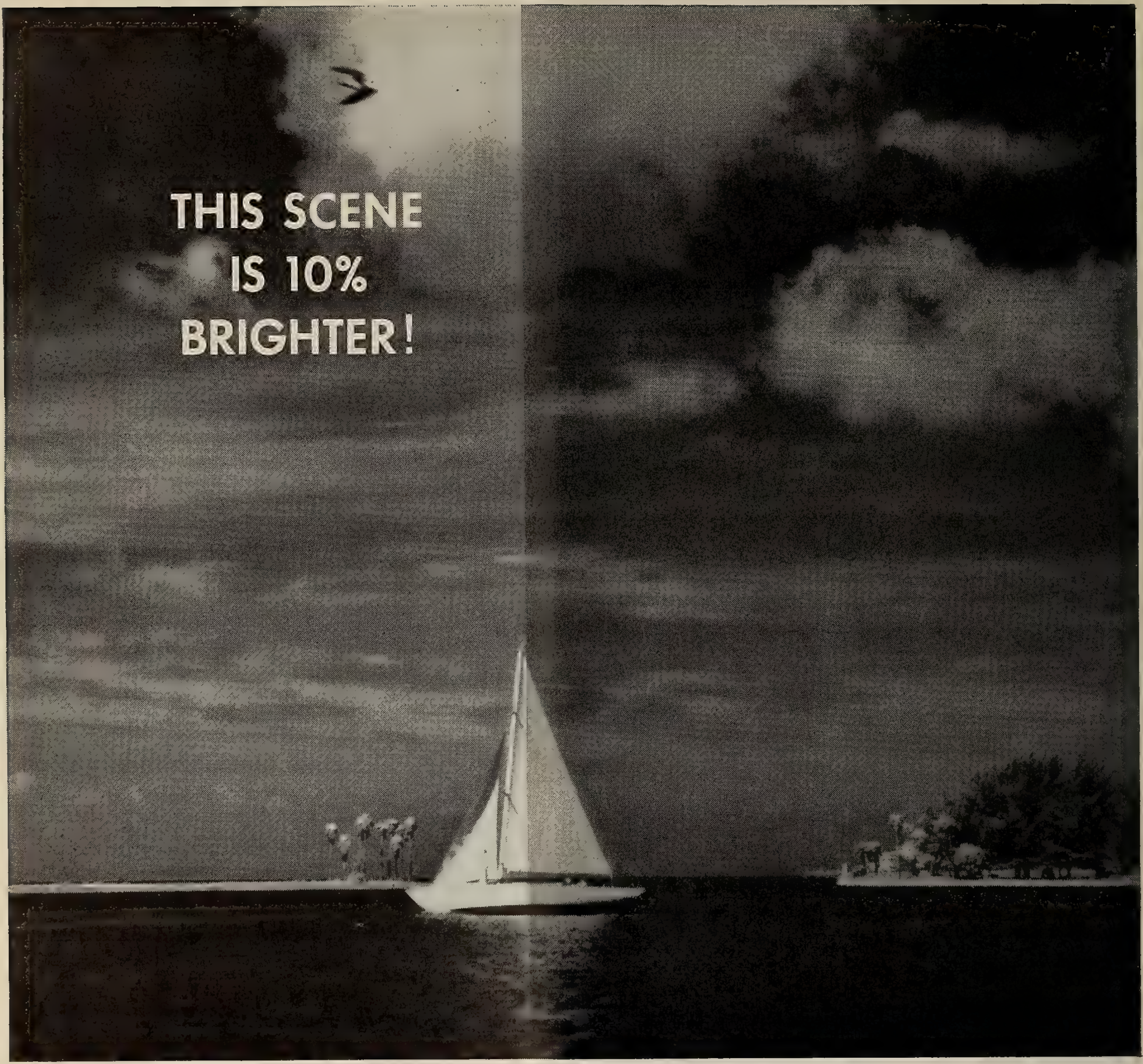


Block Diagram of Simple Volume Control

it was and is now done in not a few theatres and in studio projection rooms. And it can be done easily in several other ways.

In this example there is required only a selector switch in the projection room and a gain control in the auditorium. The remote control could be connected in series with the projection room control, but this, while eliminating the necessity for the selector switch, might lead to some confusion.

When a fader is used for both volume control and changeover, the additional series control should be used so that projectionists can make a normal changeover. In this case the fader would be run up to the top step when the remote control is to be used, and the remote control likewise when the projection room control is to be used.—JAMES J. FINN.



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INTERNATIONAL PROJECTIONIST

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Quality of Film and TV Images

By ROBERT A. MITCHELL

This evaluation of the comparative qualities of the visual images presented on both the theatre screen and the home TV set explores further the topics of "gamma", latitude, and contrast and their impact on both processes.*

THE commercial TV image, made up of 525 horizontal lines from the top of the raster to the bottom—more than 25 times coarser in structure than a modern 35-mm film frame—cannot serve as an acceptable substitute for the theatre screen, despite the fact that it is often "passably" good. The TV "Late Show," utilizing a 16-mm reduction print of an antique feature film, demonstrates this fact nightly.

The limiting factors of pictorial quality in *any* picture-reproducing process are numerous. Image definition, texture of the image, scanning-line moiré effects, etc.; brightness, tonal fidelity[1], latitude of photography, and the contrast range of the reproduction are among the factors common to all such media.

For the present let's ignore all of these factors except those affecting the trueness of the reproduced tones (black, white, and the intermediate grays in a monochrome system); the range of tones, or brightnesses, which the pickup device (TV camera tube or movie negative film) is capable of recording; and the range of brightnesses which the reproducing device (TV receiving set or positive film print) is capable of reconstructing. Here are some of the terms used in connection with these all-important quality factors:

Latitude: The range of brightnesses in an "original scene" (or in a series of sensitometric exposures) to which a film emulsion or TV camera tube responds.

Contrast Range: The range of brightnesses in the reproduction (developed film, projected picture, or TV tube image) from the deepest blacks to the brightest highlights. If the blacks in the picture are *absolutely black* (uncontaminated by flare or spill light), the contrast ratio is said to be "infinity-to-one" ($\infty : 1$), regardless of the brightness of the highlights.

Gamma: The mathematical index of both latitude and contrast. (Refer to p. 6 of the October, 1958 IP for the mathematical derivation of gamma.) An overall gamma of 1 for a finished picture means that the brightnesses of the originally photographed or televised subject have been reproduced in exact ratio. A higher gamma signifies a "contrasty" picture; a lower gamma denotes a "thin" image.

Linearity: The straightness of the main portion of a "gamma curve" plotted on graph paper. The usually curved ends of the line are called the "shoulder" and "toe," both denoting an undesirable compression of tones in the extreme highlight and shadow regions of the image.

H & D Gamma Curves

Figure 1 illustrates graphically the meaning of "gamma curves" or, as they are called in photography, "H & D curves" after Hurter and Driffield, two early investigators of photographic sensitometry. In 1B we see plotted three such curves, the two in dashed lines expressing the latitude-contrast characteristics of two developed emulsions, negative and positive.

The negative curve in Fig. 1B slopes less steeply than the positive curve. It is, in fact, customary for negative films to have lower gammas than positive films. A less contrasty, or "soft-

*This article may be considered a continuation of the basic discussion of contrast factors in projection in the October, 1958 issue of IP ("Image Contrast and Picture Quality," p. 5, et seq.).

[1] "Tonal fidelity" is sometimes called "tonal linearity" and "gray-scale fidelity."

er," emulsion records a wider range of brightness—that is, it has a greater latitude.

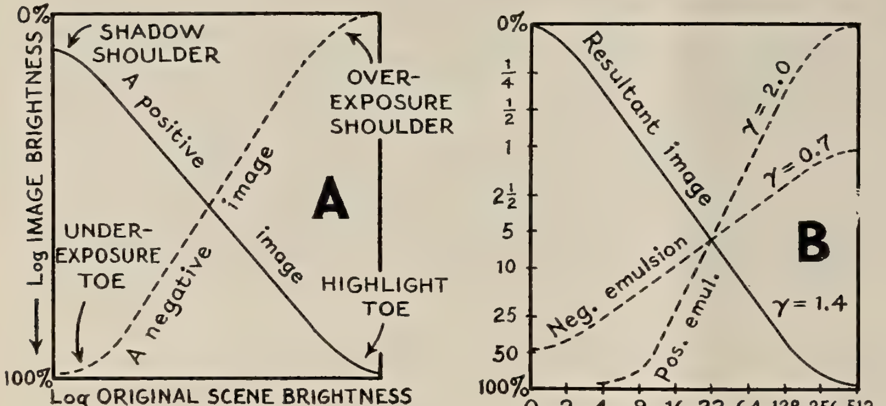
Only the straight-line portion of a gamma curve is normally useful, inasmuch as the overexposure shoulder and the underexposure toe *compress* the highlights and shadow tones, respectively, and thus prevent the recording of detail in the extremely bright highlights and in the deeper shadows.

Too much curvature in the shoulder region results in "burned-out" highlights; excessive curvature in the toe causes "blocked" shadows. A high gamma aggravates the shoulder and toe difficulties. Indeed, if a positive film having a steep straight-line region were used in a camera, adequately exposed and then given normal development, the highlights would be so burned-out and featureless, and the shadows so blocked and devoid of detail, that we should have what is called a "soot-and-whitewash" picture! A contrasty film has little latitude.

It must be kept in mind that emulsion gammas imply that the film is given its specified normal development after exposure in camera or printer. The type of developer used and the development time influence the gamma of the finished image. Moreover, many very contrasty emulsions can be made softer, with an increase in latitude, by pre-fogging the film in dim light. As a rule, however, the pre-fogging technique has the undesirable effect of curving the straight-line part of the gamma curve.

The curves in Fig. 1B are normal for black-and-white motion-picture photography and printing. The negative gamma of 0.7 results in a "thin" image having little contrast. The photographic latitude of this negative film is remarkably broad, however, because the straight-line section of its gamma curve extends over a wide range of "original-scene" brightnesses.

The very contrasty positive gamma of 2.0 is chosen to "balance" the low negative gamma. Although the straight-line part of the positive curve covers only a small range of exposure brightnesses (restricted latitude), it is nevertheless long enough to include most of the "tones" of the negative images *because the developed negative has so little contrast!*



Positive-type image: gamma (γ) = 1.2

Negative-type image: gamma (γ) = 1.5

FIGURE 1. These "H & D" diagrams show how the contrast characteristics of developed film images, projected-picture images, and TV picture-tube images are plotted. As shown in *A*, the negative-type images produced in non-reversal film emulsions are plotted so that the image brightness is greatest at the point of least exposure—the darkest areas of the original scene.

The positive-type images of prints and TV pictures, on the other hand, are plotted so that the brightest part of the image corresponds to the brightest part of the original scene. The two types of "gamma curves" thus slope in opposite directions.

Negative (camera) films usually have low contrast and gamma values; while the emulsions of positive films are more "contrasty" and thus exhibit steeper H & D gamma slopes. This may be seen in *B*, where these two emulsions are plotted in broken lines. The negative gamma of 0.7 and the positive gamma of 2.0 are customary in professional motion-picture work. Multiplied together, they result in an overall, or positive-image, gamma of 1.4, which is just a bit on the "contrasty" side. This is shown by the solid line.

Refer to the text for a discussion of the way gammas affect photographic "latitude" and image contrast.

Latitude and Contrast

What is important, therefore, is the *overall* gamma—the contrast characteristics of the finished picture print. An overall gamma of 1 is technically (but not pictorially) ideal because it reproduces *exactly* the contrast ratios of the original scene.

For example, suppose a lighted movie set has a highlight level of 500 foot-lamberts and a shadow level of 25 foot-lamberts. This is a 20:1 brightness ratio. Then suppose an overall gamma of 1 is employed for the print, and that there are no contrast losses in projection. If the projected highlight images have a brightness on the screen of 10 foot-lamberts, the shadow regions will have a level of 1/2 foot-lambert. This is also a contrast ratio of 20:1.

In actual practice, however, a higher overall gamma is employed to overcome certain small contrast losses in projection occasioned by lens flare, light dispersion by the silver grains in the film emulsion, and an appreciable, though low, level of ambient light falling upon the picture screen. Moreover, a slight exaggeration of contrast imparts a "snappy," sparkling quality to the picture and thus makes it visually more pleasing.

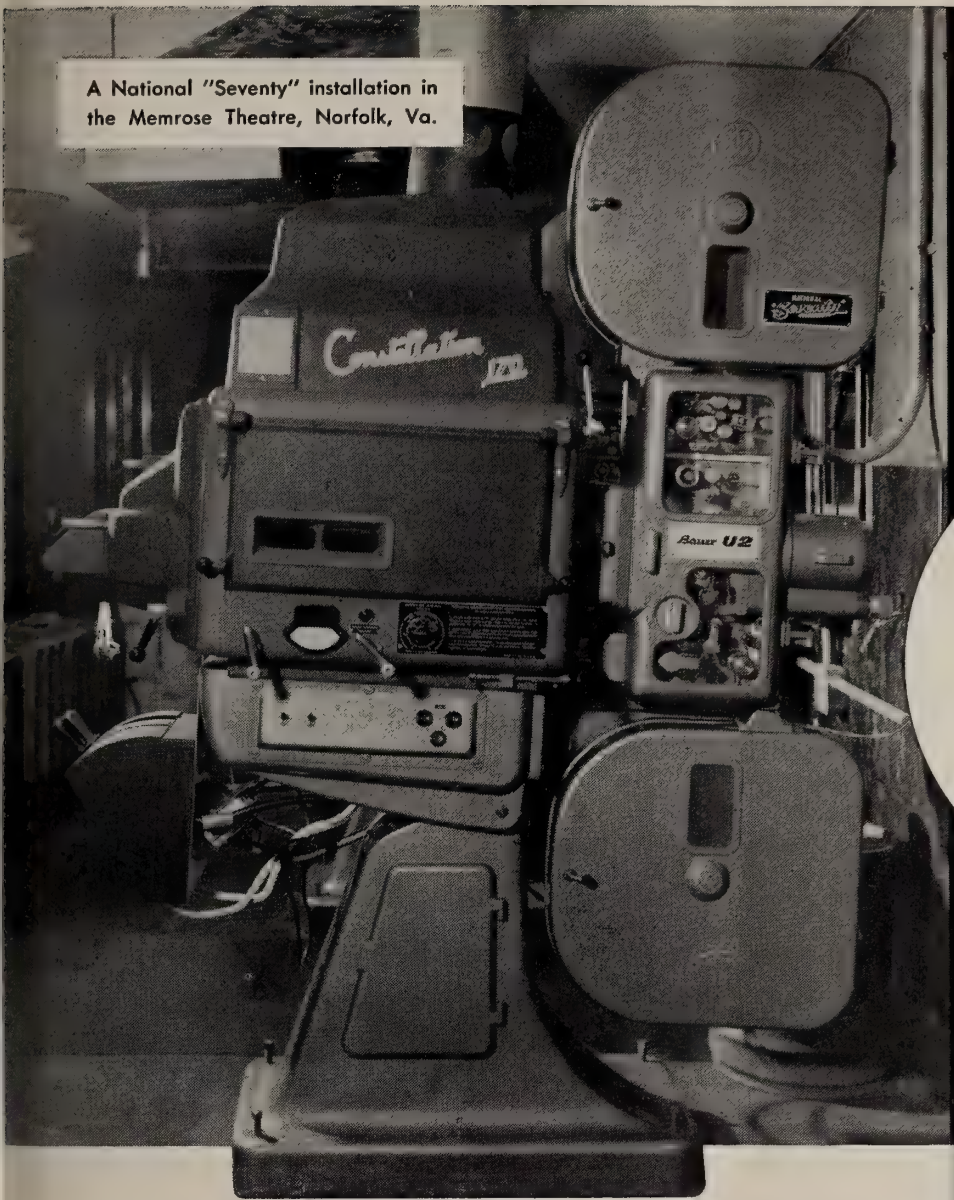
It is nevertheless true that extra pictorial contrast exacts a price, for if the contrast (gamma) is pushed too far, some degree of highlight-burning and shadow-blocking necessarily occurs.

Normally, an overall gamma of 1.3 to 1.5 is considered satisfactory for the picture portion of monochrome theatre-release prints. (Soundtracks may require a lower overall gamma.) In Fig. 1B the negative and positive gammas of 0.7 and 2.0 result in an overall gamma of 1.4 (solid-line curve):

$$0.7 \times 2.0 = 1.4$$

Now let's consider the exposure latitudes and contrast ranges of these two films, which are quite typical. The negative has a latitude ratio of approximately 150:1, meaning that, in the photography of an outdoor scene on a sunny day, it is capable of recording, as distinct tones, the entire range between a sky brightness of 2100 foot-lamberts and a dark-shadow brightness of 14 foot-lamberts.

Still brighter and darker areas of



A National "Seventy" installation in the Memrose Theatre, Norfolk, Va.

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Special features of the National "Seventy":

- **Separate sprockets** are provided for each film width—single screw fastening of the sprockets means practically instantaneous removal.
- **Optical and magnetic sound** components are an integral part of the projector housing rather than separate "added-on" units.
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- **Lens mount** is rugged and exceptionally accurate—can accommodate any focal length lens for presentation of 70mm or 35mm.
- **Projector Drive** motor is connected directly to mechanism and provides for film speeds of 24 or 30 frames per second.
- **Automatic Circulatory Lubrication** eliminates need for special attention.
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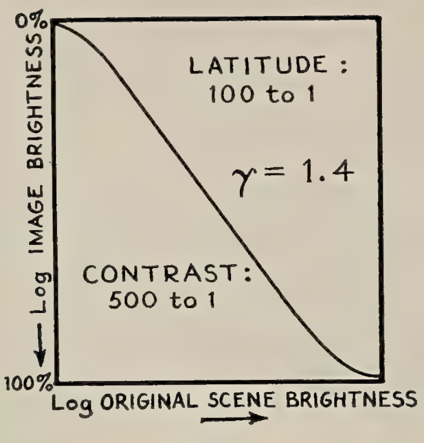


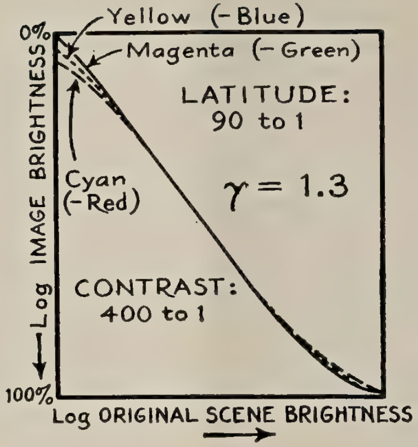


FIGURE 2

Black-and-white film print

Color (multi-layer) film print

the scene (*e.g.*, a cloud brightness of 10,000 foot-lamberts and a deep-shadow brightness of 5 to 10 foot-lamberts), will be featureless in the image because of shoulder and toe compressions.

The positive film, given normal development, has little latitude (about 25:1), but this is sufficient to include the contrast ratio of the "thin" negative image (20:1). The contrast capabilities of the positive emulsion, on the other hand, are simply tremendous—about 900:1 from the densest deposits of silver in the image to the clear film.

Fully utilized, this vast range records the 20:1 contrast ratio of the negative image as a positive-image contrast ratio of approximately 500:1 or more from the burned-out highlight region to the blocked shadow region. At an overall gamma of 1.4, however, the "significant gray scale" included in the negative latitude of 150:1 is printed out as a contrast ratio of 210:1.

Film image contrast ratios in excess of 400:1 or 500:1 mean very little, actually, because as the contrast ratios become higher they rapidly approach infinity. It would be difficult even for a trained observer, comparing two pictures, to detect the difference between a contrast ratio of 500:1 and a ratio of 1000:1—or even 1,000,000:1! The TV people who boast about contrast ratios of 1000:1 or greater make little impression upon theatre projectionists who produce upon the screen far more pleasing and natural-looking pictures at contrast ratios between 200:1 and 600:1.

Color-Film Quality

The latitude-contrast characteristics of multilayer, dye-coupler color films are only very slightly inferior to those of black-and-white, as shown in Fig. 2. (For purpose of comparison, there is in the left-hand panel the overall black-and-white gamma curve.) The right-hand panel shows a normal curve for Agfacolor overall gamma—about 1.3. As a rule, color negatives are more contrasty than black-and-white negatives, so the color print is accordingly developed to a lower gamma to give the desired overall gamma—between 1.3 and 1.5, as stated previously.

Except for color-balancing during printing and the addition of dye-forming chemicals to the developer, the processing of color film is similar to

(*Continued on page* 21)

New Kodak Color Negative Doubles Speed, Definition

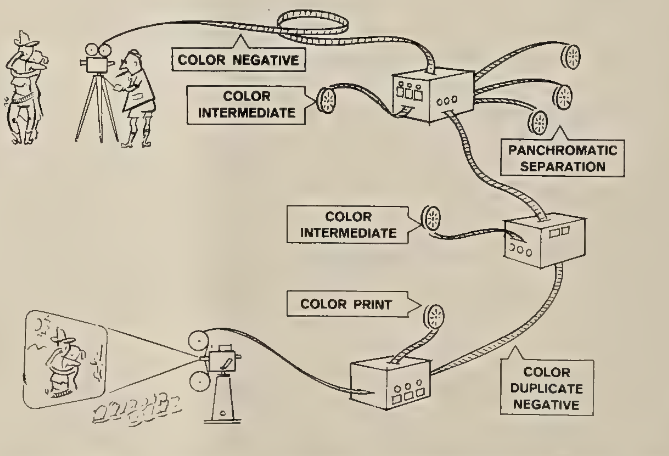
INTENSIVE RESEARCH and development has again contributed an important technological advance to the motion picture industry in the form of a new 35-mm color negative film introduced by Eastman Kodak Co. Having *twice* the speed of negative color materials in current world-wide use, this new film has been proved in trade tests by more than 400 motion picture companies.

The new color negative film known as Type 5250, is twice as sensitive to light as present Eastman negative material, surpasses the present product in color rendition and requires no special processing or handling. Fine grain and definition characteristics retain the same high standards. It is manufactured in 35-, 65-, and 70-mm widths and comes in standard footages of 100, 400, 1000 and 2000.

Enhanced Screen Definition

Dramatic impact of wide-screen spectaculars will be enhanced by the sharper long-shot definition possible with Type 5250. Smaller lens openings will bring far-distant objects into sharper focus. A lone tree on the horizon, for example, will present more detail to the audience, just as the approaching horse-and-rider will the sooner be seen with more clarity.

Type 5250 will be supplied on special order until expanding production makes possible offering as a regular order product.



Professional Color Motion-Picture Film — *from* *Scene to Screen*

As shown here, the scene is recorded on Eastman color negative film. Then, to add special effects, duplicating stages are employed to give a color duplicate-negative which is used alone, or combined with the original negative, for making the final release prints for screening in theaters. The duplicating operations are carried out in either one of two ways:

In the first method, black-and-white separation positives are made from the original negative onto Eastman Panchromatic separation film. These separations are then printed in register onto Eastman color intermediate film to give the color duplicate-negative. In the second method, color intermediate film is used for preparing both a color master-positive and a color duplicate-negative.

The Videotape* Recorder

By GEORGE B. GOODALL

Ampex Corporation

This is the fifth, and final, article in a series on the Ampex Videotape Recorder. It discusses the servo control systems, editing and splicing procedures, and the duplication of recorded tapes.

V. CONTROL SYSTEMS AND SPECIAL TECHNIQUES

AS PREVIOUSLY indicated, certain servo control systems were necessary to enable the rotating video head approach to be a practical solution to the problem of recording and reproducing the video signal. Four servo systems are employed in the Videotape Recorder.

HEAD-DRUM MOTOR SERVO SYSTEMS

Two servo loops are employed in the head-drum motor circuit. The first acts to eliminate fast-phase correction requirements for the motor; the second minimizes any tendency of the motor to "hunt".

The head-drum motor rotation is controlled by a 60-cycle system reference frequency. In the record mode this frequency may be derived from the vertical synchronizing pulses in the video signal, from an external source, or from the power line frequency. Normally it would come from the video signal. This frequency is multiplied to 240 cycles routed through a phase-comparator circuit and motor-power amplifier, and then used to drive the head-drum motor.

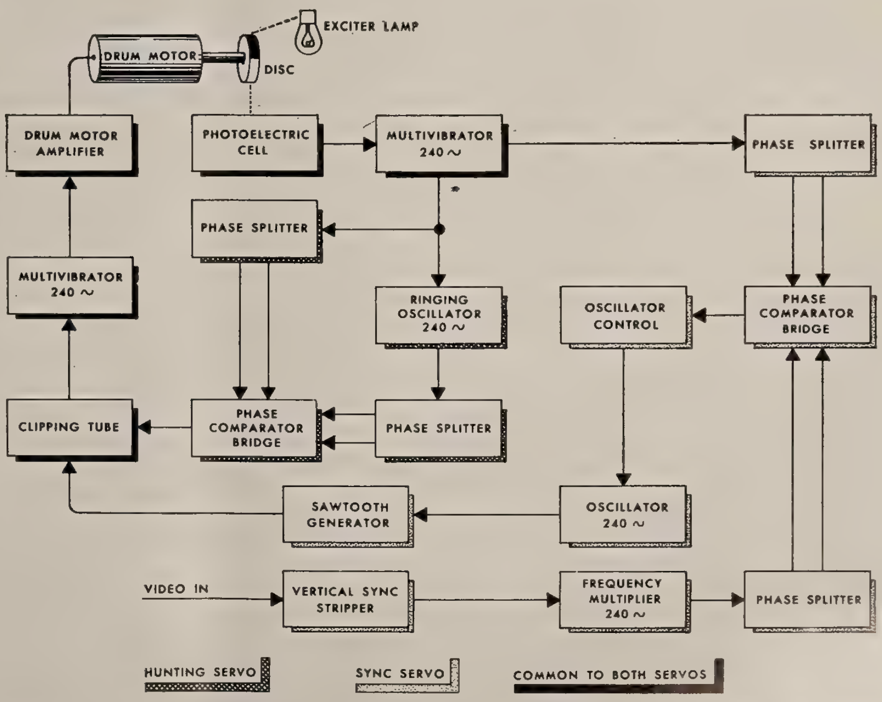
The 60-cycle vertical sync is stripped off the video signal, multiplied to 240 cycles, split in phase, and used to provide two of four inputs to a phase-comparing bridge circuit. The other two inputs to the phase comparator are supplied by the photoelectric cell, whose output is split in phase. These last two inputs are directly dependent on the position and speed of the rotating heads.

The phase-comparator generates an error voltage whenever the sync signal suddenly shifts in phase—for example, when an inductive load is applied to the sync line. This d-c error signal controls the frequency of a voltage-controlled oscillator; however, a large error signal will not immediately affect the oscillator, but will gradually shift its frequency. The output of the oscillator is converted to a saw-tooth wave and is connected to the third grid of a clipping tube. Now let's develop the signal to the first grid of that tube.

The second drum-motor servo loop utilizes the photoelectric cell output as the excitation signal to a low Q ringing oscillator, resonant at 240 cycles. The resulting signal is again an approximate 240-cycle square wave, whose phase is displaced from the original by 90° plus or minus an amount proportional to the difference between the actual photoelectric cell output and 240 cycles. [This additional phase shift occurs if the signal is not exactly 240 cycles and is the result of feeding a non-resonant signal through a resonant circuit.] The output of the ringing oscillator is split in phase and provides two of the four inputs to another phase-comparator bridge arrangement.

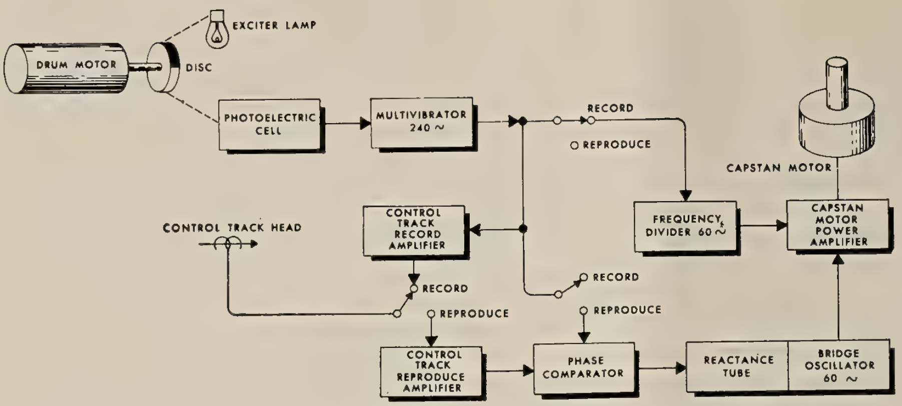
The other two inputs to the phase-comparator bridge are derived from the photoelectric cell output, which is split in phase. The phase-comparator will emit an error voltage whenever the two pairs of input signals are not in phase: for example, if the head-drum motor velocity changes during a "hunting" period. The instantaneous output voltage is proportional to any instantaneous difference between the actual frequency from the photoelectric cell and 240 cycles. The error voltage is further processed, and then is connected to the first grid of the clipping tube (which we introduced three paragraphs ago).

The clipping tube now has a saw-tooth wave on the third grid which will vary gradually as incoming sync varies, and a voltage on the first grid whose amplitude will vary instantaneously with any transient variation in motor speed. The two signals are combined in such a way that the even-



Simplified block diagram of the two head-drum motor servo systems. Note that certain components are common to both servos.

*Trademark, Ampex Corporation.



As shown on this simplified block diagram of the capstan motor servo system, capstan motor rotation is controlled by the drum motor in the "record" mode, and by the comparison of the reproduced control track and the drum motor signal in the "reproduce" mode.

tual signal has a linear phase-shifting characteristic proportional to both.

This last signal is the one that controls a multivibrator circuit, whose output is amplified in the motor drum amplifier and then used to drive the drum motor. The motor will thus be brought gradually into synchronism with any change in sync phase or frequency, but will be rapidly corrected for transient shifts in motor speed "hunting."

CAPSTAN MOTOR SERVO CONTROL SYSTEM

During the record mode the 60-cycle system reference frequency is the primary motive force for the drum motor, as we have seen. The cell scans a rotating disc on the motor shaft and generates a 240-cycle signal whose phase and frequency are dependent on the head drum. This signal is progressively divided by two, with a resulting 60-cycle signal supplied to the capstan motor circuit. The rotation of the capstan motor during recording is thus electronically-coupled to the rotation of the head drum. The 240-cycle signal is also recorded on the bottom edge of the tape as a control track.

In the reproduce mode, the recorded 240-cycle control track is reproduced from the tape and compared in phase with the output of the photoelectric cell. Both these signals are converted to square waves and connected to a phase-sensing circuit. As long as they are exactly 90° out of phase there will be no error voltage generated. However, when the phase angle from the control track and the photoelectric cell differs from 90°—which will occur if the capstan rotation is not synchronized with head drum rotation—a resultant positive or negative d-c voltage will be created.

This voltage controls the operation of a reactance tube which is one of the frequency-determining elements of a bridge-oscillator circuit. The bridge-oscillator output is routed through the capstan motor power amplifier to the capstan motor.

Any phase error is thus translated into a control voltage which varies the frequency of oscillation and thus corrects the capstan motor speed.

TAPE GUIDE SERVO SYSTEM

We have already seen how the position of the concave tape guide is vitally important in producing interchangeable tapes. The final servo system in the equipment controls this placement.

In manual operation the position of the guide is controlled by the manual adjustment of a potentiometer which forms one branch of a self-balancing bridge. The other branch of this bridge consists of a precision potentiometer which is mechanically-geared to a tape guide motor. A voltage differential across the bridge is created when the manual control is reset.

This voltage is amplified in the Tape Guide Amplifier unit and used to control the tape guide motor, which will operate to rebalance the bridge. In moving to correct the unbalanced bridge position, the motor repositions the guide, which is mechanically coupled to it.

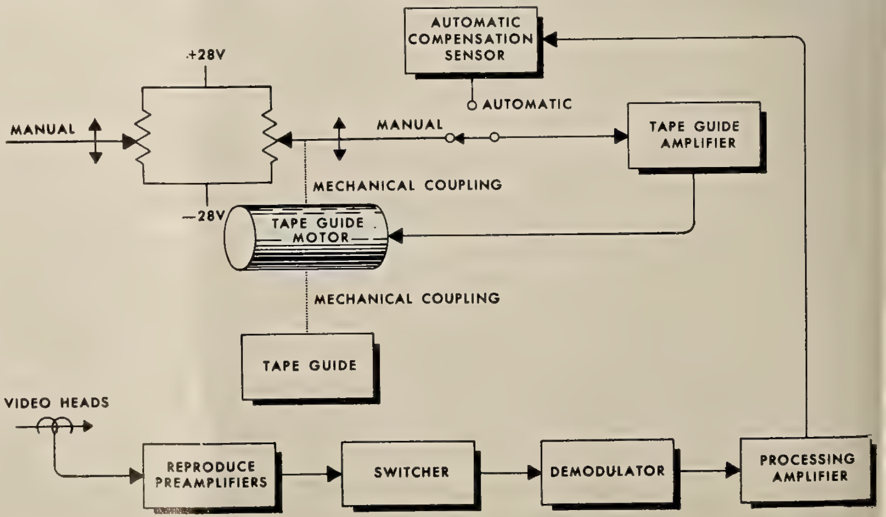
Automatic operation is possible *only* in the reproduce mode. Under automatic control the tape guide motor is controlled by the Automatic Compensation Sensor Circuit. This unit detects time displacement errors in the horizontal sync pulses which immediately precede and follow a head-switching interval, as compared with the horizontal sync pulses during a normal period.

If a timing error be produced each time the heads are switched, the charging time for a capacitor is either lengthened or shortened, and the capacitor will charge to a greater or lesser potential than normal. This signal is further processed and then used to drive the Tape Guide Amplifier which in turn supplies power to the tape guide motor to reposition the guide and correct the timing error.

EDITING AND SPLICING

Field-indicating pulses are derived from the photoelectric cell output, which is differentiated into pulses and then passed through a gating tube. The gating tube passes these pulses only

The tape guide servo system is shown here in simplified block form. The tape guide amplifier controls the tape guide motor. Automatic operation is possible only in the reproduce mode.



when they occur in coincidence with the vertical sync, thus every fourth pulse from the photoelectric cell is passed. These pulses are then combined with the control track signal and magnetically indicate on the tape the vertical blanking time interval.

If we now make the magnetic recording visible, we can make our splice immediately following this vertical blanking time and there will be no discontinuity in the control track signal. The TV picture will not then be affected (an improperly made splice will cause picture "roll-over").

A recent Ampex product called "Edivue" suspends metallic powder in a solution. When Edivue is applied to a recorded TV tape, using a special wick-type pen, the metal powder adheres to the magnetized tracks (in much the same way that iron filings form a pattern on a sheet of paper laid over a magnet). The solution quickly evaporates, leaving a visual pattern of metal powder marking the magnetic fields on the tape, with the field pulses appearing as sharp blips on the bottom edge of the tape.

Two methods may be used in locating the exact spot for editing. The first is to manually move the tape past the audio head until the proper spot on the soundtrack is located; the tape is then marked at the video head.

The second method is to watch the TV monitor and stop the equipment the instant the desired scene is reproduced; the tape will move approximately 4 inches after the desired scene is viewed (this takes the reaction time of the operator into account) so the tape is marked 4 inches to the right of the head-drum. The maximum deviation here will be 2 picture frames, and will be invisible to viewers. There are *60 splicing points in every second* of picture information and the point nearest where the tape was marked may be used.

The audio record head is 9¼ inches, or 0.62 seconds in tape travel, behind the video head. This time lag provides a workable basis for splicing, permitting cuts during a scene change, *or even between words.* Exact synchronization is always maintained between sound and picture, since it is inherent in the TV recording process the same as it is in the motion picture recording process.

The removal of *one second* of sound means the loss of *30 frames* of video information, and if the picture was of an object in motion a jerking movement would be noticeable. If, however, the splice is made at the beginning or end of a scene, no effects will be apparent.

Actual cutting and splicing should be done using a precision machine, the Videotape Splicer, now available from Ampex. This equipment allows cutting to an accuracy ±1 mil. The two tape ends are placed in the splicer. Micrometer knobs are used to position the field pulses on both pieces of tape under hairlines on a lens, then a single-edge razor blade is inserted in a cutter guide and drawn across the width of the tape. As both tape ends

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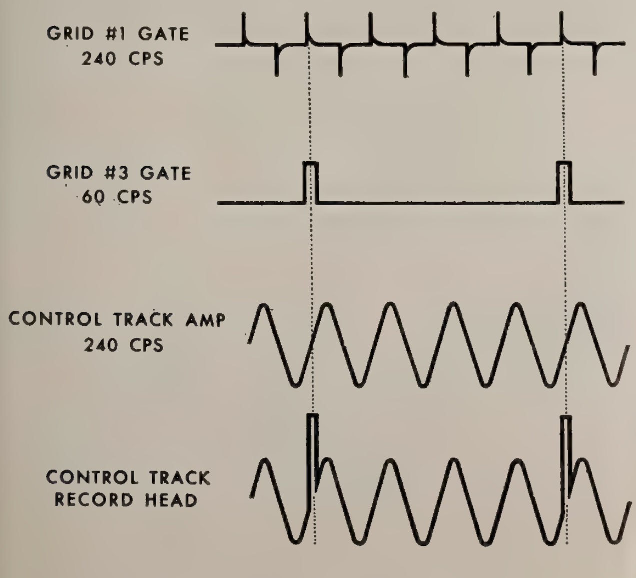


• This diagram illustrates how the field indicating pulses are mixed with the control-track signal.

LETTERS TO THE EDITOR

IP Goofs—And How!

To the Editor of IP:

Naturally, I am disappointed that in "Letters to the Editor" on page 13 of your July issue you did not range me alongside such old-time projection *afficionados* as Ray Brian of Peoria, Ill., and James Card, curator for Eastman House, Rochester, N. Y. Both of these gentlemen are well-known to me.

Attached is a reprint of my paper, presented before the Society of Motion Picture and Television Engineers at its Spring meeting in 1958, together with a foreword by Mr. Bernard D. Plakun. Prints of a 35-mm film based on the collection in my Museum are available from (and I hope for many requests from projectionist organizations) Herbert Barnett, National Theatre Supply Co., 92 Gold Street, New York City 38.

DON MALKAMES
7 Plymouth Ave., Yonkers, N. Y.

EDITOR'S NOTE: That we should have omitted mention of Mr. Malkames is unforgiveable, considering our long-time association with him. We shall try to make amends, however, by appending hereto an excerpt from the introductory note to the SMPTE paper aforementioned:

"DON MALKAMES' personal collection of old projectors, gathered over the past 25 years, includes more than 100 projector mechanisms and numerous accessories, dating back to the middle-1800's.

"To see and handle the material on the shelves and to hear Malkames glowingly describe the place that each piece occupied in the history of motion pictures, is a memorable experience. On picking up a small brass film can, just large enough to fit snugly into a shirt pocket, you may learn that it had once been used to carry all the film needed for an entire evening's show—which might run only 40 feet!

"The background hangings in the Museum breathe of a past era. Billboard posters advertising the triumph of motion photography or a scene from President McKinley's inauguration (both from the year 1897) create a feeling of excitement, as though one had just been newly introduced to the miracle of pictures that move . . ."

It's what's on the screen...and what people say about it...that counts

Addendum: "Cold" Mirrors

Communication From Zeiss Ikon, Ag., Stuttgart, Germany

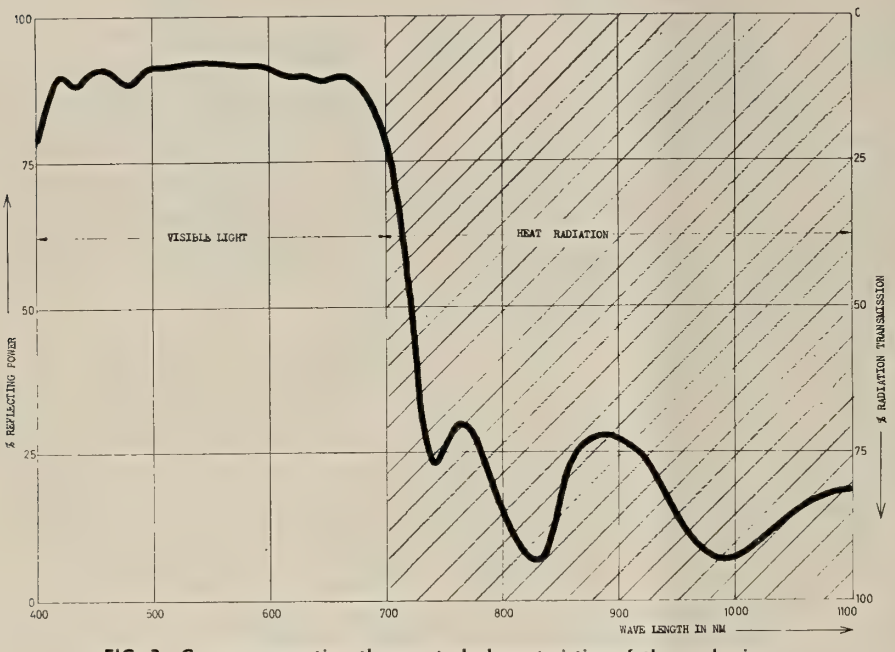
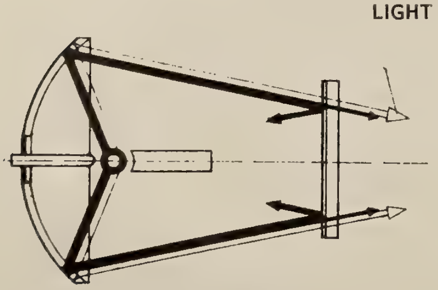


FIG. 3. Curve representing the spectral characteristics of the cool mirror.

THE "cold" mirror is a decisive step toward solving the all-important projection problem of cooling the film, the lamphouse, and the projector mechanism itself. The "cold" mirror, like heat-reflection filters, has an *interference* layer consisting of a number of very thin layers of extremely hard materials composed of vitreous substances.

This layer has been calculated so that it reflects the visible light but lets through almost all the heat radiation. The heat-reflection filter separates the incident radiation so that the visible light passes unobstructed, while the invisible heat radiation is reflected back toward the light source. This is the difference between the layer of the "cold" mirror and that of the filter.



(Arrows represent heat.)

FIG. 1. Illustrating the silvered mirror with heat-reflection filter. The mirror reflects all radiation, from which the heat rays are eliminated by the filter to a high degree.

The different mode of operation is clearly shown in the diagrams, Figs. 1 and 2. Figure 1 shows the usual manner of projection by means of a silvered mirror and heat-reflection filter; Fig. 2 shows the new method with the cool-light mirror.

Filter Layer Limited

The heat-reflection filters are calculated so that approximately half of the heat radiation accompanying the light is eliminated. Significantly greater effectiveness of the filter layer is, for physical reasons, impossible to obtain. In contrast to this layer, that of the mirror (Fig. 2) reflects only the visible light, while the heat radiation is eliminated from the beam of rays. The different effectiveness of the mirror and the filter determines the limits of their application.

While for medium amperages the heat-reflection filter will be sufficient, the use of a cool-light mirror is recommended when higher amperages are employed. Externally, the cooling mirror differs from the silvered mirror by the reflecting interference layer which has replaced the silver coating. In contrast with the silver mirror, the coating of the cooling mirror has no protective lacquer layer. On one hand, the lacquer layer is not necessary because the interference layer is much harder and more corrosion-resistant than the silver coating and, on the other hand, protective lacquer would even be harmful, since it would prevent the heat radiation from penetrating the mirror.

In reflecting power, the cool-light mirror is slightly superior to the silvered mirror. All spectral colors of the projection light are evenly reflected by the "cold" mirror. This requirement, from the practical point of view a commonplace demand, is however not guaranteed without further adjustment. Intense development work was necessary to provide a reflection characteristic of the vitreous layer which covered the entire visible spectrum, as shown in Fig. 3.

Careful Adjustment Necessary

When the interference layers are adjusted less carefully, a narrower characteristic can occur, with a too early disintegration of the reflecting power in the blue-violet and yellow-red range of the spectrum. This loss in reflecting characteristic will not impair the projection of black-and-white films, but would result in distortion with color film. If differences in the color characteristic of the light reflected by various Zeiss Ikon "cold" mirrors can be establshed at all, they will lie within acceptable tolerances and will never cause conspicuous color distortion.

If the gases of the arc should after some time deposit the well-known white coating on the front of the mirror, the latter can be cleaned like a silver mirror. Since with the back-coated mirror the boundary area between the glass and the mirror coating determines the reflecting power, and as the glass can be soiled by dirt but this area cannot change, the full reflecting power is always retained, although the penetration of heat may change slightly.

In addition, the mirrored surface is turned away from the carbon arc so that it is usually only dirt which soils the mirror. The back of the mirror needs cleaning only occasionally, that is to say, when much dust has accumulated.

For cleaning the layer on the back of the mirror, the same instruction as for the heat-resisting filters should be fol-

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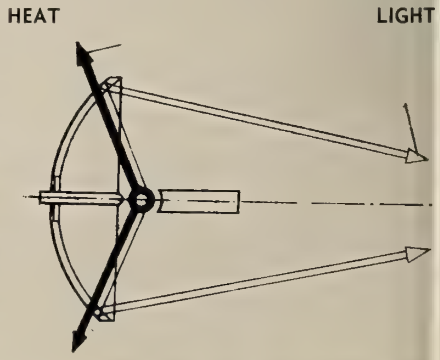


FIG. 2. With the "cool light" mirror there is reflected only the visible light; the heat radiation passes through it.

Non-Intermittent Projectors? Maybe, But...

HAVING BEEN a subscriber to and cover-to-cover reader of IP for more than 20 years, I congratulate you for your excellent service to our craft. During the past few years as a Board member, and the last two as vice-president of IA Local 165 (studio projectionists) I have served on numerous educational committees and have drawn heavily on your articles and editorial for information. Now I have another favor to ask.

Continuous Projector an Intriguing Thought

Our film laboratory is a modern and most progressive organization intent upon using every means available—and if the means not be available of creating same—to improve motion-picture film processing. Projection is no side issue here, which fact makes for a very satisfying atmosphere in which to work.

Presently I am designing projection equipment for laboratory use in special departments such as color timing and release print inspection. In some instances, since light is not a limiting factor for short throws, the use of continuous projectors with optical rectification of the image, rather than intermittent movement of the film, is an intriguing thought.

Units Need Not be Complete

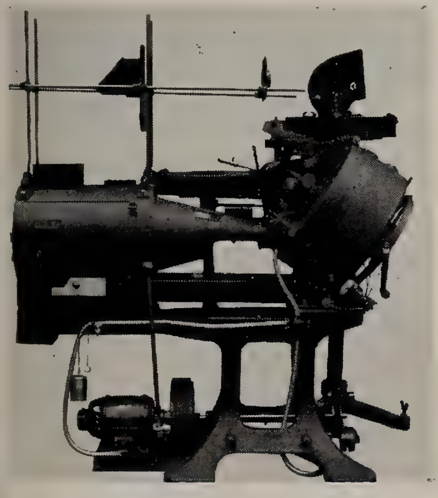
Perhaps IP can put me in touch with someone who may have prototypes of such equipment and would be willing to sell it to us for further modification and experimental work. Units need not be complete, and either rotating prisms or mirrors may be the means of optical rectification. As this is strictly a non-profit project, it is difficult to justify the expense of grinding prisms and lenses until the design is proven.

DON V. KLOEPFEL, Projection Supervisor

General Film Laboratories, Hollywood, Calif.

IP HAS no record of anyone now active in the continuous-projector field. A thorough search of the literature, including the European area, has been non-productive of any positive results relative to the idea posed. The Mechau (operated for a brief span in the Capitol Theatre, New York, back in the 1920's); the Vig, Holman and Comes projectors of the same period, represented the last serious effort to reduce the continuous projector to practical use.

The Mechau was probably the most successful of all these types, being based on the oscillating-mirror principle. Several of these still are used in the TV studios of the British Broadcasting Co.—and it may be news to most projectionists that Dr. Alfred N. Goldsmith, inventor of the RCA trichromatic color TV tube, used them when he headed the research staff of the old RCA Photophone Co.



This is the way the Mechau oscillating-mirror, continuous projector looked (and still does in the British Broadcasting studio in London). Apparati at top on suspended rods is for the showing of advertising slides, common practice outside the U.S.A.

"Strong Cup of Tea"

These Mechaus actually worked (still do) but they were too strong a cup of tea for the day-in-and-day-out rigors of modern projection procedure. A cracked mirror surface, for example, meant a shutdown for a tedious repair job.

The new Philips shutterless projector has a 5:1 sprocket movement which has not yet been shown in the United States. It could be either an accelerated geneva movement similar to the Simplex X-L, or a drunk-cam movement like the one Philips already manufactures for a 16-mm sprocket machine.

The use of an intermittent ratio of at least 5:1 (if the 2-3-2-3 type of movement is not used) is necessary in color-timing apparatus when the closed-circuit TV system, which works from color negatives by phase reversal, operates on 60-cycle current. Although we are not quite sure what sort of experimental color-timing apparatus Mr. Kloepfel has in mind, we rather suspect that he would save time and effort by making use of already available projectors for TV use.

Optical Advantages Nebulous

We seriously doubt (judging from what we have heard about the Mechau) that a continuous projector has any advantages over a regular intermittent machine for release-print inspection. For one thing, there is just enough vibration of the image to preclude the best resolution; and correction of this troublesome feature of an oscillating-mirror machine poses an herculean, and undoubtedly costly, engineering project.

The prism machines would appear to be eliminated by the fact that optimum image-forming optical conditions never prevail except for one brief instant per frame of film, and thus give poor results definition-wise. To repeat, we do not know exactly what Mr. K. has in mind, but we still believe that it might be futile to concentrate too much on the optical-compensation principle. It has never worked out satisfactorily.

The drawbacks inherent in both the mirror-type and prism-type continuous projectors are so little amenable to practical engineering solution that it is no wonder such machines have been abandoned by design engineers. Optical compensation is a will-o'-the wisp.

Continuous Projection Data

HERE ARE a few references of especial interest to the serious student of continuous projection by optical compensation as reflected by the pages of IP during the past 28 years during which it has manifested an interest in this topic:

"Some Interesting Properties of Continuous Projectors;" Journal of the Society of Motion Picture Engineers for June, 1931, Vol. XVI, No. 6.

"The Art of Continuous Projection," by William C. Plank; IP for Nov., 1931, p. 22, *et seq.*

"Continuous Projection by Optical Compensation" (direct communication from the makers of the Mechau projector in Germany), by H. A. Robiczek; IP for March, 1932, p. 14, *et seq.*

Progress Report on Educational TV

By FRANCIS E. ALMSTEAD
Special Consultant, New York State Education Department

IN AN era when man-made moons and rockets in outer space and the range of intercontinental ballistic missiles are accepted as common knowledge by the American public, the technological wonder of mass-produced television sets is sometimes overlooked. However, educators have seen in this device a means whereby countless numbers can be taught more economically and more effectively. It has been determined that TV may be expected to play a vital role in helping to solve some of education's building and manpower problems.

During the 1958 session, the New York State Legislature authorized, and Governor Harriman approved, the establishment of educational TV in New York City, and funds to operate the project were appropriated to the State Education Department. On June 27 the Board of Regents awarded the contract for broadcasting educational programs in the metropolitan area to station WPIX, Channel 11, a station owned and operated by the New York Daily News.

[NOTE: Although there are 40 educational TV stations either on the air or with plans to start broadcasting within the next few months, the Regents Education Television Project of New York State is unique. It is the only educational TV project which has leased time for its programming from a commercial station]

The broadcast schedule consisted of materials and experiences which would test existing theories, and was designed to support public education with regular lessons in Spanish, mathematics, science, citizenship education, English, music, and arts and crafts. Special programs and in-service training courses were also included.

Program Scope and Progress

September 22, 1958, the project was launched. Telecasts were beamed during the daylight hours, five days a week, to elementary and secondary school classrooms within a radius of 100 miles. Located within this inter-state viewing range are more children than in any single state in the Union. Two-thirds of the two and one-half million public school children of New York State live in counties where the signal is received.

The project has the largest market in the world from which to draw a viewing audience. There are nearly as many TV sets in the Channel 11 viewing area alone as there are in all other markets in the nation having educational TV stations. From the project's inception until February 24, 1959, when a preliminary survey was completed, the accompanying tabular analysis was compiled.

The programs were very well received by home viewers as well, as evidenced by the more than 15,000 letters and cards received as of February from an at-home audience. The pre-school program *"Fun at One"* is currently competing for first position with a CBS program in the Arbitron daily ratings.

Problems To Consider

During the year's operation, the State Education Department had kinescope recordings made of several of the courses. Requests for their use have come not only from schools but also from other states and countries.

The complexity of the operation gave rise to certain anticipated difficulties which, through lack of time and manpower, prevented fuller use of educational TV by the schools during the project's first year. Several of these problems are: (1) too few TV receivers in the schools; (2) inadequate study guides; (3) incomplete communications to classroom teachers prior to the broadcasts, and (4) lack of worthwhile workshops for studio and classroom teachers. In planning for next Fall's operations, the Department has taken steps to overcome these difficulties.

Vital Guideposts

The Department's Division of Educational Communications has formulated the following guide posts in its administration of the Regents Educational Television Project:

1. That instruction by TV should be institutionally connected. (Content for elementary and secondary school subjects are selected from State syllabuses.)
2. That TV lessons should bring to the classroom situations and experiences not usually available in all schools.
3. That the importance of both stability and flexibility in planning TV lesson plans be recognized.
4. That a continuing evaluative process be maintained.
5. That the State Education Department regard its function primarily as a programming authority, not as a program producer, responsible for the approval and scheduling of telecasts, for supervising their quality, and for maintaining a balance in the subjects and population served.

Studio teachers were obtained

Analysis of In-School TV Viewing For Regents' Educational Project (Channel 11)

As of February 24, 1959

	Sept. 1958	Nov. 1958	Jan. 1959	Feb. 1959
TV Receivers	200	506	1,500	1,742
No. Schools with TV Receivers	96	230	609	756
No. Classrooms with TV Receivers	916	2,452	6,326	7,276
Estimated No. Pupils Viewing TV	27,480	73,560	189,780	218,280
No. Sets School District Plans to Order	—	—	—	576*

*Survey not yet completed

through viewing area Boards of Education and were released halftime from their regular teaching assignments generally three days a week.

Utilization—Evaluation for 1959-60

The project will continue through the 1959-60 school year with a diversified program schedule designed essentially for elementary and secondary school viewing. The schedule contains lessons which can be used in one of four styles of utilization:

1. Those programs not associated with a specific course structure but which are intended as "extra-class" experience.

2. Those programs which are well-defined, well-planned, deliberate experiments in team teaching.

3. Those programs which are planned for "total" teaching.

4. Those programs designed for direct teaching.

Because of a reduction in State appropriation for Educational Television, it has been necessary for the Education Department to reduce airtime from 7 to 5½ hours each weekday.

Included in the broadcast schedule are 20-minute programs in science, art, mathematics, language, music, and citizenship education for the elementary grades; for the secondary levels: 40-minute sessions in mathematics, physics, reading, citizenship education and English. "Special" programs such as Book Reviewers, Almanac, news broadcasts and a pre-school program have also been included.

The Education Department, realizing how essential evaluation is to the improvement and continuation of educational TV, is planning an evaluation schedule for selected programs for the 1959-60 school year.

This is the tentative plan of evaluation for both TV and non-TV classes: for mathematics 10, physics and advanced Spanish 3-6, a test at the beginning of the term and one or two tests at the close of the term, both taking into account the objectives to be achieved; an information schedule covering conditions of reception, pupil reactions and ratings, and teacher reactions and ratings.

For beginning Spanish 3-6, a test at the close of the term and an information schedule covering pupil and teacher reactions.

For elementary news broadcasts, a questionnaire to TV students only and to teachers covering reactions and results.

The New York City Board of Education plans to conduct an experiment in mathematics 8 and reading 7. The

Department, also, urges evaluation on a local level of all TV-taught classes.

Since last Fall, the project has progressed rapidly and surely. However, only continued exploration, research and evaluation will result in the quality of programming and vitality of approach which the State Education Department considers desirable.

* * *

Slide Brochure by Strong

A NEW BROCHURE which details the progress in the development and improvement of techniques used in slide projection has just been produced by The Strong Electric Corp. It shows how the area of commonly used screens has been enlarged up to 100 times during the past third of a century, and tells why a constant increase in the brilliancy of light source at the projector has been necessary.

Illustrated and described is modern equipment which will brilliantly project ordinary 3¼″ x 4″ and 2″ x 2″ slides on screens up to 30 feet wide in rooms which need not be darkened. This equipment is ideal for use where it is desirable to maintain room illumination for taking notes. A free copy is available upon request to Strong Electric Corp., 31 City Park Avenue, Toledo 1, Ohio.

Now, What do You Know?

FROM A PROFESSOR of Greek in a locale which, while in New Jersey, may best be left unmentioned, we received the following communique:

"I note in my A-V work that you consistently change the spelling of '*disc*'. The original word is the Greek *diskos*. Some authorities prefer the '*k*' for this reason. However, it came into Latin as *discus*, so there is also ancient authority for the 'c' spelling. Therefore, in the future, I'll spell the word *d-i-s-c*."

400 Projectionists See NTS 35/70 N. Y. Show

UNDER CIRCUMSTANCES that might well develop into a nation-wide pattern for demonstrating the new 35/70-mm (Bauer) projector now being distributed by National Theatre Supply Co., projectionists from the various IA Locals in the

IA Local 306 worthies at the National Theatre Supply Co. press party to show the new 35/70-mm projector. Left to right: Izzy Schwartz, secretary of 306 and former bantamweight champion of the world; Steve D'Inzillo, business representative; Dave Shapiro, president of the Square Club, a Masonic organization, and Jack Winick, representing "Cleveland justice."

Metropolitan New York area were invited to an all-day, open-house exhibit of the projector and arclamps incident thereto. Official sponsor for the exhibit was Projectionist Square Club, fraternal group of Local 306.

The exhibit attracted more than 400 projectionists. Exhibitors and managers were not invited because of the desire to give the gathering an all-projectionist status. Arclamp manufacturers C. S.

Family portrait: Mrs. Mary Ashcraft, Clarence Ashcraft, and their son, Bud, at the Square Club—sponsored showing of National Theatre Supply Co.'s new 35/70-mm projector.

Ashcraft and The Strong Electric Co. cooperated by displaying their lamps and having representatives on hand to explain operational characteristics.

"Smitty" Did The Chores

Prime mover in organizing the exhibit and seeing it through to a successful conclusion was Allan G. Smith, manager of the NTS branch in New York. This Texas transplant is a tremendous favorite of projectionists in his area, thus the success of the show was assured.

The idea is much too good to be dropped with the New York show, and it is recommended that in any locale where at least 150 projectionists can be assembled, application be made to NTS to stage such an exhibit. They'll supply all the equipment and, likely, arrange for exhibition space.

OBITUARIES

Edward Hoad, member of IA Local 173, Toronto, Canada, died suddenly recently. He was a member of this brotherhood for 27 years.

W. R. Bell, member of IA Local 173, Toronto, Canada, died suddenly recently. He was a member of this brotherhood for 27 years; also, a member of the Musicians Local. Driving his car to the job, he collapsed at the wheel.

[EDITOR'S NOTE: Not only because the writer of these few words is a gold-card, honorary life-member of Local 173, but for the welfare of the craft at large, we beg of your charity to always remember our own Will Rogers Memorial Hospital at Saranac Lake, New York, or the Harry Sherman Heart Fund, administered by that old-timers' group, the 25-30 Club of New York. Even nickels and dimes will do.]

Photoelectrons : Photographs *(Slide-Rule, Please?)*

Recently-evolved ideas about what goes on in a photographic film in the fraction of a second that elapses as one takes a picture were reported by Dr. William West, of Eastman Kodak Co., at a recent joint meeting of the Chemistry Teachers Club and the Physics Club, of New York City.

Dr. West spoke of the mechanism by which light of a *certain* color sets in motion a chain of events from which the final picture is evolved.

Each square inch of photographic film contains *several hundred million* crystals of the light-sensitive chemical silver-bromide, Dr. West said. When light strikes one of these crystals, a few electrons are liberated: then these electrons combine with silver-ion atoms (which are already minus an electron) to form metallic silver.

This tiny speck of silver in the silver-bromide crystal is called a "latent image." Though it is much too small to be seen with a microscope, it causes the transformation of an entire silver-bromide grain to metallic silver during photographic development. This little silver "trigger" to a chemical reaction gives the photographic process an amplification of about 1 billion! in a "fast" film, the scientist said.

Dr. West further discussed the sub-atomic changes caused by light in film. These basic phenomena are under constant study by Eastman Kodak.

Dr. West explained that the silver-bromide crystal will react only to blue light and light of shorter wavelength. For this reason, in order to be sensitive to green, yellow, and red light, each crystal must be coated with a layer of dye *only one molecule thick* to absorb light of other colors and permit it to act on the crystal. Films so sensitized are *panchromatic*, or equally sensitive to all colors.

Are You Moving?

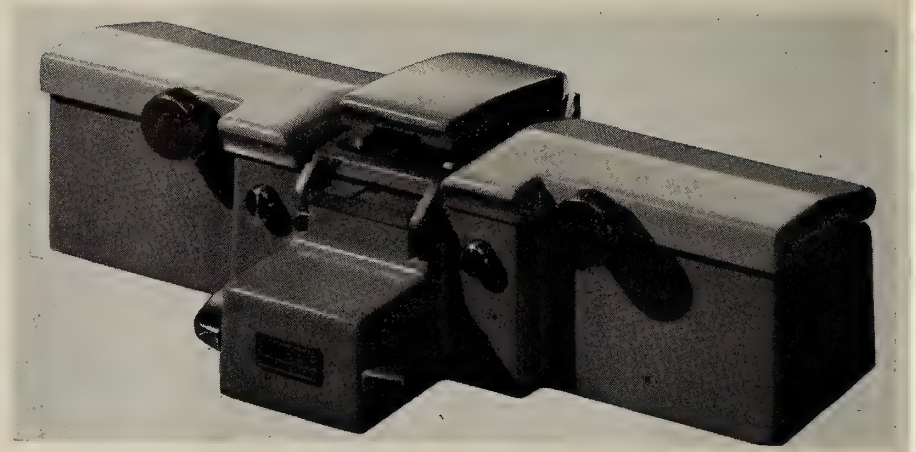
If so, please notify us one month in advance. The Post Office does not forward magazines. To avoid delay, please cooperate by sending us both your *new* and *old* address.

VIDEOTAPE RECORDER

(*Continued from page* 11)

are cut simultaneously, a perfect butt splice is assured.

Without removing the tape from the splicer, the cut ends are lifted and special splicing tape is run underneath. The tape ends are then lowered on the splicing tape, and a pressure arm seats the splice. The splicing tape is trimmed (again using the cutter guide) and the tape is removed from the splicer. The metallic deposit is carefully wiped off, to prevent contamination of the head assemblies, and the spliced tape is ready to be played.



Precise editing and splicing is accomplished by the Videotape splicer.

DUPLICATING RECORDED TAPES

Copies of Videotape recording are used on the air every day. A very slight deterioration in the signal-to-noise ratio occurs, but the copies are fully acceptable, in fact, even *copies of copies* have been broadcast.

The only present method of making duplicate tapes is to use one Videotape equipment as a reproducer which is connected to one, or more, Videotape machines used as recorders. The number of copies which can be made in this way is limited only by the replay life of the originally-recorded tape.

It is interesting to note that Videotape programs are now available for general distribution throughout the country. This attests to the acceptability of duplicated tape, and to the fact that complete interchangeability of tapes from machine to machine has been achieved.

Conclusion

THIS HAS BEEN a long and, in at least some instances, involved series of articles. The writer has attempted to present the basic principles of recording video on magnetic tape in language that can be understood by persons with only a fundamental knowledge of electronic circuitry and magnetic recording theory. In this attempt perhaps we have oversimplified certain aspects of the equipment; if so, it was unintentional.

We hope that these discussions have proved of some interest to you. It should be understood that this process is constantly being refined and improved—in fact, Ampex has a group of engineers searching out new applications and improved circuitry for the Videotape Recorder. But a fundamental knowledge of the design presently used will aid in understanding any new processes, which must of necessity stem from the *basic* equipment. We hope this series has aided you in attaining that fundamental knowledge.

THE "COLD" MIRROR

(*Continued from page* 14)

lowed. To avoid damaging the coating which, although very hard, is also extremely thin, it is advisable first to remove the dust with a brush and then wipe the mirror with a soft rag or cotton waste after breathing vigorously on the surface. When the mirror is very dirty the rag can be moistened with alcohol.

Generally, it is sufficient to clean the mirror at fairly long intervals. Since the cool-light mirror is coated on the back, its use involves no maintenance and cleaning procedures beyond those used for silver mirrors.

Light Fluctuations Minor

Tests in laboratories and in actual practice in theatres, using medium and high amperages, have proven that the cool-light mirror meets all the requirements expected. The film gate of the projector and the lens are certainly better cooled than hitherto. Fluctuations in definition by film warping, often a disturbing factor when high amperages are used, have in no case been observed. Such fluctuations in screen-image defini-

tion may occur in cases when projection lenses of short focal lengths or anamorphoric attachments are used.

It has been proven in practice that with the cool-light mirror refocusing is hardly ever necessary, because the film no longer warps under the reduced heat radiation. The cool-light mirror should be used generally.

The effect of a cool-light mirror or a heat-reflecting filter can only be the removal of the heat radiation which accompanies the light. The remaining visible light, being also some form of energy, still will heat up the film to a certain degree and this cannot be avoided. This remaining portion of heat still is fairly considerable with a carbon arc of high amperage and may be up to 40% of the total radiation.

The elimination of the invisible radiation is, nevertheless, a considerable improvement, since there is a critical temperature range for the thermal stress of a film. If by using a cool-light mirror the thermal stress of a film remains below approximately 158°F in actual practice, there will be no untoward results. If, however, old film prints are projected, already permanently warped, fluctuations in sharpness will occur.

Frank Cahill to Century

Frank E. Cahill, Jr., formerly coordinator of technical activities for Warner Brothers Pictures, Inc., has joined Century Projector Corp. as sales manager. Cahill is extremely well known in the film industry because of the diverse posts he has held in Hollywood studios, in theatre circuits, and in the lab field.

During World War II Cahill held the rank of Colonel in the U.S. Army Signal Corps. He finished his tour of duty as executive officer of the Army Pictorial Service. He will now headquarter at the Century offices at 729 Seventh Ave., N.Y. City.

Tremendous Kodak First Half

First-half sales and earnings of the Eastman Kodak Co. were substantially higher than a year ago and were the best the company has had for any corresponding period. Consolidated sales of the company's establishments in the United States for the first half (24 weeks ended June 14) were $400,786,235, about 13% more than sales of $353,621,635 for the similar period of 1958.

Net earnings were $52,720,909, about 41% higher than the $37,330,269 reported for the 1958 first half. A year ago, effects of the recession in general business and various special factors had resulted in a 7% drop in earnings from 1957.

FILM AND TV IMAGES

(*Continued from page 8*)

the processing of black-and-white.

Only Technicolor employs a radically different process, namely, the dye-imbibition method of printing.

The overall latitude and contrast ratios of the modern color-print image are very satisfactory. A contrast ratio of 400:1 is usual. Note, however, that the color-film H & D curve looks a bit "fuzzy" in the shoulder and toe regions—this because not one, but three, images are involved, one in cyan dye, the second in magenta dye (the most important as regards image definition), and the third in yellow.

These three subtractive-color images should be exactly superimposed in the main straight-line region of the curve (as they are here), because some rather weird color effects will be produced if the three curves have different gammas. Objects will change in color during fade-ins and fade-outs!

Complexities of TV Gamma

As for latitude and contrast in television, we find factors of a far more

complex nature. The response of the camera-tube mosaic to various intensities of illumination is not perfectly linear, but shows shoulder and toe characteristics similar to those of silver halide photographic emulsions. A camera tube behaves essentially like a photoelectric cell, but its toe characteristics are complicated by the capacitance effects responsible for image storage and by the existence of "dark currents"—the emission of electrons even when not illuminated.

Fortunately, the linearity of the video amplifiers on the broadcasting end of a TV system can be deliberately distorted to counteract any "average" departure of the camera tube from linear response over the main portion of its response curve. For all practical purposes, then, the video signal broadcast by a properly maintained transmitting station represents a perfectly linear luminous response over a reasonably wide brightness range.

Gamma trouble, when present, most often begins in the circuits and picture tube of the viewer's receiving set. Not only do many cheap receivers destroy the linearity of the video signal in the process of detecting and amplifying it, but the kinescope, or cathode-ray picture tube, nearly always imposes severe distortions upon the response curve, particularly if the tube be an old wornout one.

Response of Picture Tubes

The left-hand panel of Fig. 3 reveals what sort of response may be expected of a good picture tube at various brightness and contrast (gamma) settings when a linear video signal is coming in. The solid curves 1, 2, and 3 represent different brightnesses at the moderately high degree of contrast (gamma = 2.0) most televiewers seem to prefer. Observe that the highlights are badly burned out at the high-brightness setting (curve 1), while the shadows are hopelessly blocked at the low-brightness setting (curve 3). An intermediate brightness setting (curve 2) provides a better overall response at this gamma.

Still better results than this can be obtained from the kinescope in question by reducing the contrast to a gamma in the neghborhood of 1.3—1.5 (the broken-line curve). The response curve then compares favorably with the H & D curve of a motion-picture film print of fair quality.

Note that internal reflections of light and electron diffusion prevent deep blacks in the TV pictures at any but the lowest brightness settings.

The right-hand panel of Fig. 3 reveals the badly distorted type of response curve actually obtained with most wornout picture tubes. After a tube has been used frequently for long periods of time, the gradual development of gas within the tube and decreased electron emission from the cathode distort the response characteristic severely, and also usually decrease the latitude-range, the brightness and the sharpness of image focus.

In this curve we see the presence of blocked shadows, a non-linear main line, and a peculiar transformation of the highlight toe which not only results in burned-out light grays but produces a reversal of the brightest highlights. This visually unpleasant "negative effect" is caused by electron emission from the grid, and is especially evident when the brightness and contrast controls of the receiver are turned up high.

A wornout kinescope as bad as the one represented in Fig. 3 should be operated, if it cannot be immediately replaced, only at low brightness and contrast levels to "stretch" and straighten the main-line response over the reproduced brightness range.

Color TV Difficulties

The problem of color TV in relation to monochrome TV is even more exacting than the problem of color motion pictures relative to black-and-white prints. In addition to the necessity of absolute black-level control in color TV, the color picture tube presents registry and gain problems which have not yet been completely solved. As for the latter, the need for different drive voltages for the three electron guns (red, green, and blue) unfortunately results in slightly different gammas for the three primary colors.

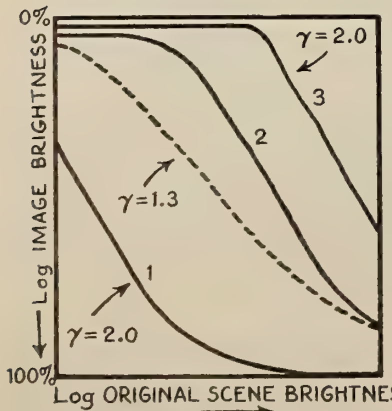
Red is the "problem color" in color TV. Not only does the red phosphor require an exceedingly energetic electron bombardment for adequate excitation, giving to the red response a gamma different from that of the green and blue, but the dominant hue of this phosphor is an orange-red (vermilion) which precludes the reproduction of reasonably saturated deep reds, carmines, magentas, purples, violets, and blue-violets.

Comparative Color Response

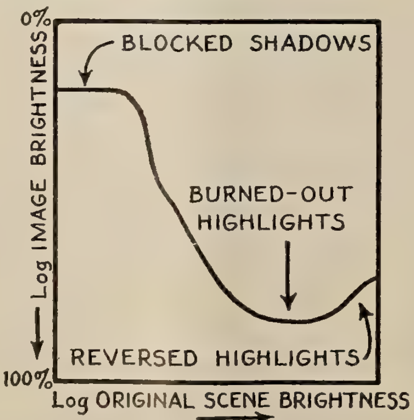
The chromatic advantages and disadvantages of color TV, and their comparison with the favorable features and shortcomings of color motion-picture prints, are not our concern here. Suffice it to remark that color TV performs best at high light levels, while color films give the purest colors at low light levels. The contrast range of modern color kinescopes is comparable to that of theatre-release prints in color.

It should be evident by comparing Fig. 2 with Fig. 3 that theatre motion pictures have a distinct "edge" over TV anent tonal fidelity. TV is very good indeed at its best, but it is still inferior to the 35-mm motion picture in every department of picture quality. If this were not true, larger and more realistic TV pictures would receive more attention from the manufacturers of electronic equipment.

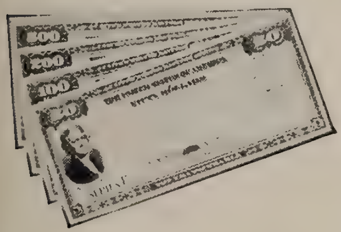
FIGURE 3. TV PICTURE-TUBE CHARACTERISTICS.

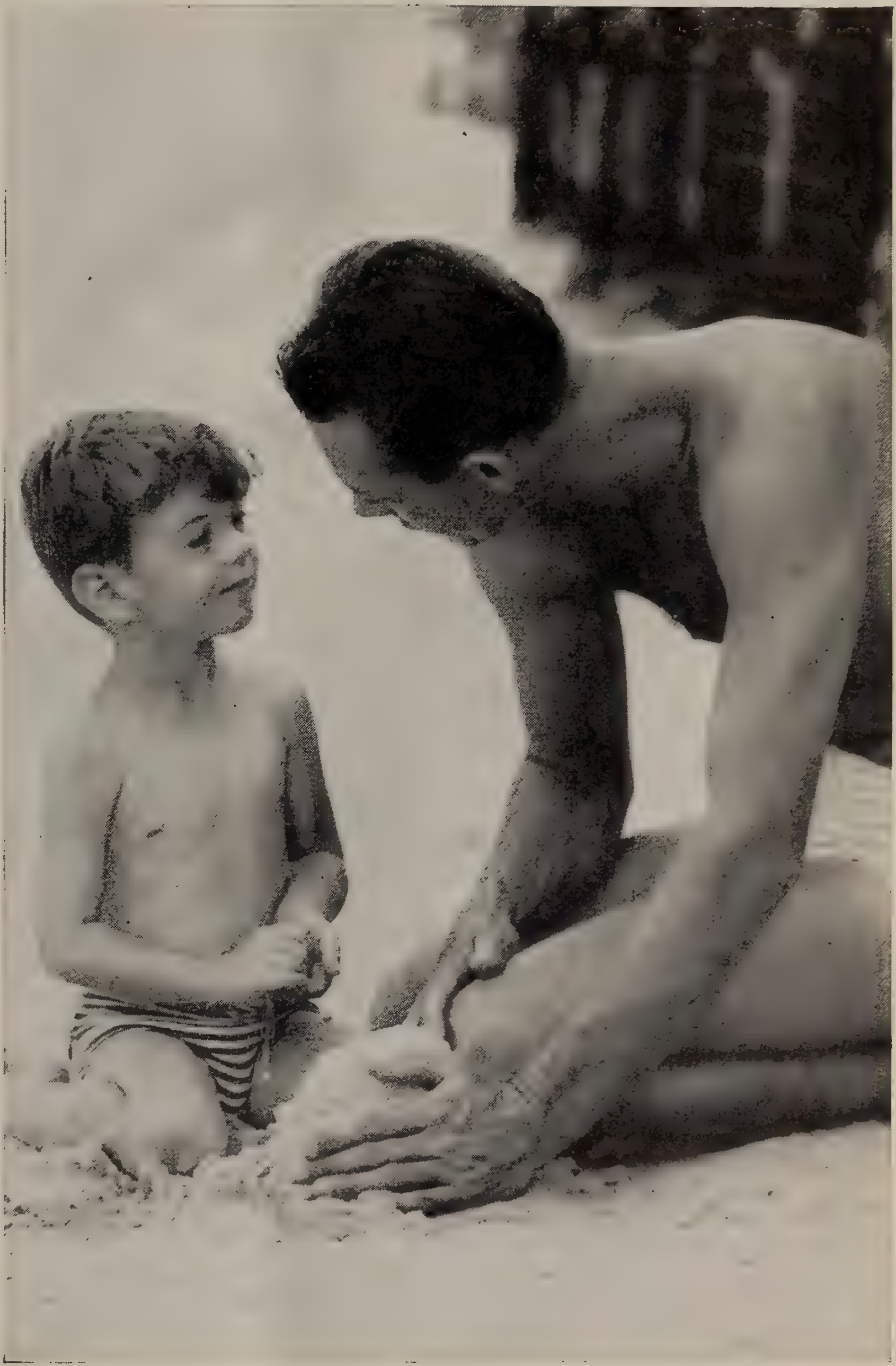


1, 2, and 3 equivalent to high, medium and low brightness: γ 2. Dotted line medium contrast.



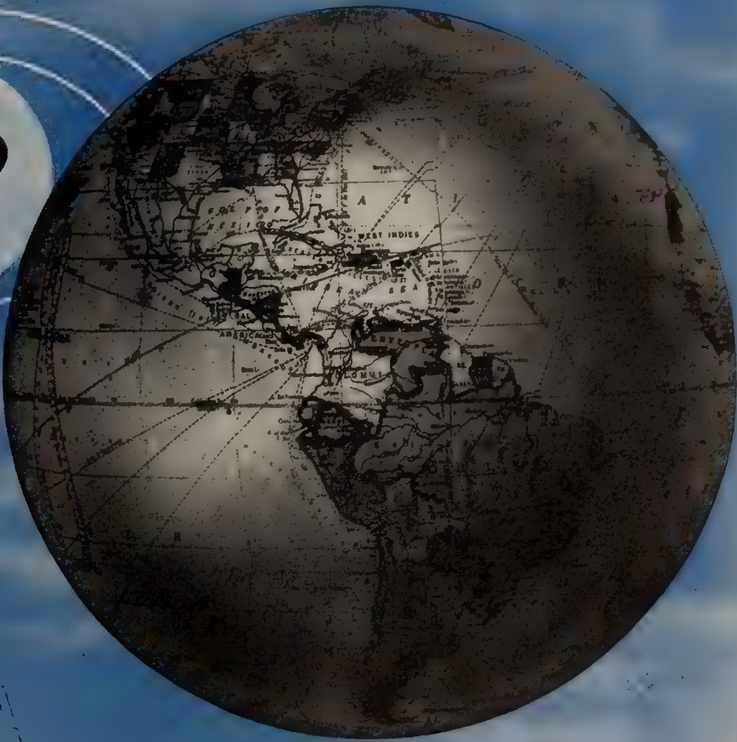
Gamma curve of a wornout picture tube and its defects. Note particularly the "highlight" slopes.





Photograph by Harold Halma

INTERNATIONAL PROJECTIONIST



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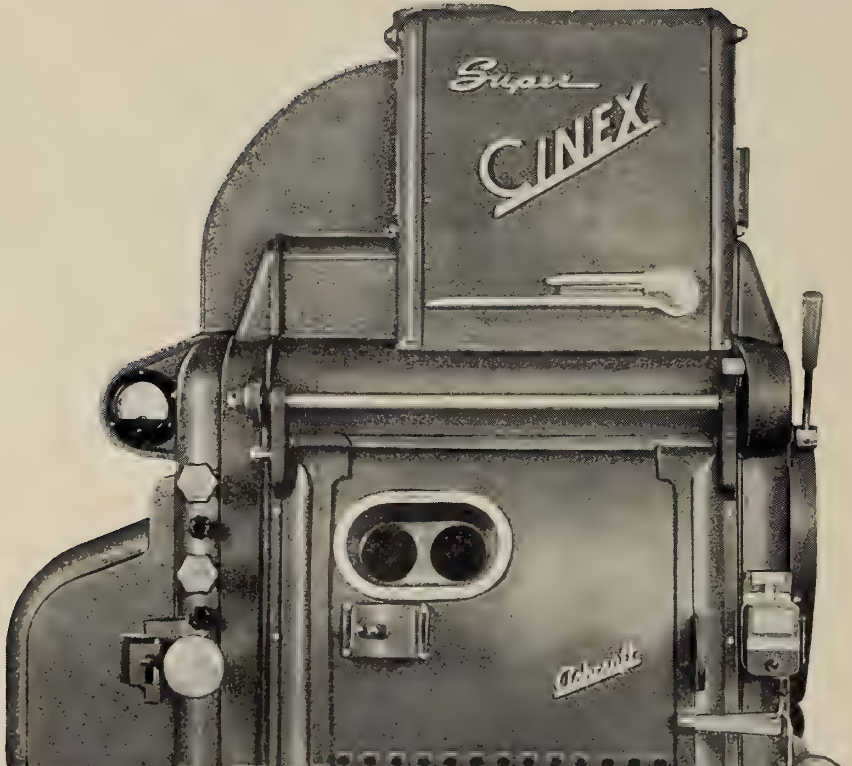

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Monthly Chat

Much Ado About Nothing

IT is becoming increasingly apparent that the pressures being exerted upon the industry to embrace the concept of tremendous-screen motion picture presentation is totally at variance with a screen image acceptable to the eye. Nowhere in the literature of the pictorial art does there appear a single justification for the static quality of screen projected images now on view.

It is the old, old story of too much of a good thing. Back in the 30's, when things were rugged financially, some benighted exhibitor conjured up the idea of giving two features for the price of one—and thereby destroyed a romantic dream. Romance may not be apportioned.

Then followed the colossal technical misadventures attendant upon these new processes: lack of dramatic content in the screen image; the utilization perforce of short-focal lenses which even the manufacturers thereof did not wish to make; the use of anamorphic attachments upon the prime lens, and the overall deterioration of the projected screen image.

What projectionist of more than 25 years experience, and thus worthy of his craft calling, would consider capping a prime optical instrument? Similarly, what craftsman would consider the use of an anamorphic attachment to expand the screen image to the hideous proportions existent today?

IP is well aware of the fact that the drive-in theatre business is today a vital economic factor in the motion picture industry, no less for the distributor than for the craft, providing both production and exhibition craftsmen with a substantial portion of their annual incomes. Nevertheless, IP states unequivocally that the process of motion picture presentation is now a bastardized art.

Not only are we destroying the dramatic content of the visual image, but we are overloading both the studios and projection rooms with a superfluity of equipment which serves not to confirm the authenticity of the screen image but confuse the viewers.

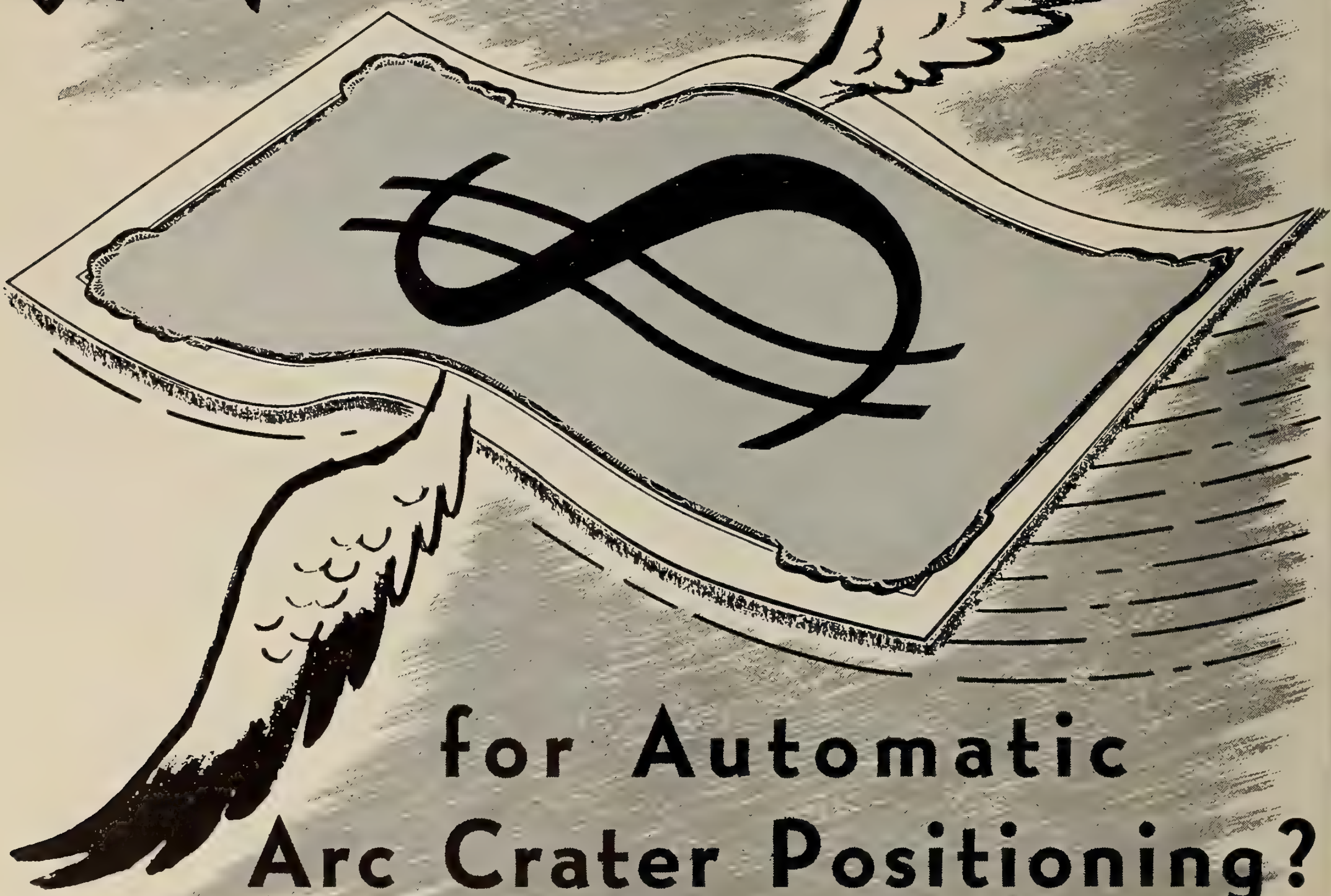
Thirty years ago there was exhibited in the Roxy Theatre in New York City a process called "Grandeur." Thirty years later along came Mr. Mike Todd and adopted the very same process to give him an elongated pictorial image. Then came the flood of excessive amperages, short-focal length lenses, wide screens, and a variety of feverish attempts to expand the screen image. In every projection room throughout this country one will find today thousands of dollars of discarded equipment which, having had a brief life, are now in the technological graveyard.

IP Doesn't Institute—It Informs

A COMMUNICATION from Sterling Dawson, member of Chicago Local 110 IATSE: "I am confused about the spread you are giving to Videotape. We lost that one to the IBEW, remember?"

ANSWER: IP administers nothing; it merely informs. Magnetic tape is being used and constantly being improved. Its increasing importance in production and reproduction, in which fields the IA craft is predominant, imposes upon IP the responsibility of keeping its readers abreast of current developments. Tape is an exotic medium which points the way toward the future, where automation might well not require the services of anybody but the original producer. Recognizing this fact, IP's responsibility is to keep its readers informed.—JAMES J. FINN.

Why Pay Extra—



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INTERNATIONAL PROJECTIONIST

Volume 34 SEPTEMBER 1959 Number 9

Film Transport Past The Aperture

By ROBERT A. MITCHELL

Practical data anent the function, maintenance and wear characteristics of vital parts of the projector mechanism.

A MOTION PICTURE reproduced from a series of photographic "frames" on film depends upon a peculiar and precisely controlled mode of film movement past the "optical gate" of the projection machine. The projectionist expresses this fact by saying that the film must be moved intermittently past the aperture-and-lens setup. It is nevertheless not absolutely mandatory to employ a "stop-and-go" film movement: the so-called "continuous" projectors produce the same end result on the screen by imaging smoothly flowing film with rotating prisms, lenses, and mirrors.

There are so many practical disadvantages in the continuous method, however, that all manufacturers of theatre projectors make exclusive use of the historic, and indisputably superior, system of fixed optics and an intermittently-moving film.*

The intermittent mechanism has thus aptly been called "the heart of the projector." When the intermittent is faulty the projection is faulty. It is the "prime mover" of the film through the gate and past the all-seeing eye of the lens.

A large number of ingenious film-moving devices have been tried out since the wonderful idea of movies first occurred to the mind of man. Some of these, like the old "dog" and beater movements, are too inaccurate, noisy, and rough on film to suit modern cinematic requirements.

Three Catagories of Movements

We may, in fact, group all modern intermittent movements into three categories: the claw, the pinwheel, and the drunk-cam families. The familiar geneva movement and the excellent, but now obsolete, Powers pin-cross movement both belong to the pinwheel family.

The shuttle-claw movement, accurate in registration but noisy and rough on film in pulldown ratios higher than 3-to-1, is used in projectors of substandard gauge because it is simple and inexpensive, and in highly refined form in many professional 35-mm cameras because it can be made to perform with extreme registration accuracy. Many Hollywood movies are photographed with such claw-movement cameras as the Mitchell; but this type of movement disappeared from the professional-projector field soon after use in the very first projector, the Lumière Cinématographe (1894).**

Sprocket-type intermittents (the pinwheel and drunk-cam groups) are characterized by silent operation, great registration accuracy when well made, extremely long life, and gentle film-pulling characteristics with no chance of the film becoming disengaged, as it sometimes does in claw-type projectors, and missing a pulldown stroke.

If you slowly turn one of your theatre projectors by means of the handwheel, carefully observing the action of the intermittent sprocket as you do so, you will notice that the sprocket accelerates to its maximum velocity very gradually from the "at rest" dwell state, and just as gradually de-

---

*The only practical contender to the "intermittent projector" existing today is the flying-spot film-scanning machine now coming into use for television purposes. This machine, described on pp. 102-104 of "Mitchell's Manual of Practical Projection," can be used *only* for TV, not for screen projection. (TV engineers are referred to Holman, Newton, and Quinn, "A Flying-Spot Film Scanner for Color Television," *Journal* of the SMPTE, March 1959, p. 137 *et seq.*)

**For an easy-to-understand explanation of the action of claw movements, see "Intermittent Movements for 16-mm Projectors" by R. A. Mitchell, IP for April 1959, p. 10 *et seq.*

celerates after passing the pulldown peak of maximum velocity. The gradualness of the acceleration and deceleration of the sprocket makes the 35-mm geneva intermittent movement both quiet and kind to the film at all pulldown ratios from the unmodified 3-to-1 to the "accelcrated" 5-to-1 ratio (Simplex X-L Hi-Speed).

The Drunk-Cam Movement

The drunk-cam sprocket movements, depending as they do upon a specially grooved cam and a pinwheel or roller-wheel device for the pulldown action, can be made to work at almost any desired pulldown ratio and with the desired acceleration-deceleration characteristics. Although somewhat more difficult to manufacture than geneva movements of comparable quality, they are nevertheless ideal for 16-mm machines because of their quietness and gentle handling of the film.

It seems strange indeed that the drunk-cam type of movement has not come into as wide use in America as in Europe for narrow-gauge projectors. The high-speed claw movements used in most American 16-mm machines are murderous to the film and so noisy that, if installed and used for a long time in theatre projection rooms, chronic deafness would surely become the chief occupational hazard of the projectionist's profession! A wider availability of the popular high-grade European projectors on this side of the Atlantic would be most welcome.

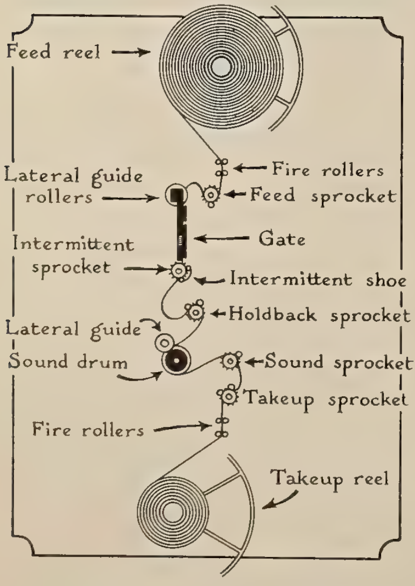


FIG. 1. The film-contacting components of the film path of a standard American-type theatre projector.

The complete film path of a modern theatre projector may seem complicated to the uninitiated, but it is designed for ease of threading and satisfactory accomplishment of three special functions: (1) intermittent movement of the film in the mechanism gate, (2) super-smooth continuous film travel past the soundhead scanning beam, and (3) the trouble-free winding of the film on the takeup reel which may hold 2000, or even more, feet of 35-mm film.

Figure 1 shows the film path of the usual American type of theatre projector, all parts omitted from the drawing except those which actually touch the film. (The film course of the usual European type of theatre projector is slightly different due to a different placement of the sprockets, rollers, and sound reproducer, but the essential parts—feed sprocket, gate, intermittent sprocket, and sound and takeup sprockets—are arranged in the same order.)

Lateral Guide Rollers

Let's concentrate upon that section of the film path which is particularly vital to projection quality, the gate of the mechanism. We find (1) flanged lateral guide rollers at the top of the gate, (2) polished steel runners upon which the perforation margins of the film rest, (3) a gate door with tension pads to hold the film flat in the gate, (4) the picture-window, or aperture, (5) the intermittent sprocket, and (6) the intermittent-sprocket shoe (usually attached to an apron on the gate door). All these parts are shown in Fig. 2.

1. The lateral guide rollers align and steady the moving film sidewise. The lateral positioning of the outer "fixed flange"—the one nearest the projectionist as he stands at the operating side of the machine—determines the alignment of the film. This flange should never be moved more than about 1/32 inch on either side of its median position, however, or the film may be twisted slantwise in the gate just enough to enage the teeth on only one side of the intermittent sprocket.

The inner movable flange—the one farthest from the projectionist—is spring-loaded to press gently upon the edge of the film and bring the film up snugly against the fixed flange. The edge of the film nearest the projectionist as he stands in operating position is accordingly the *guided edge.* The

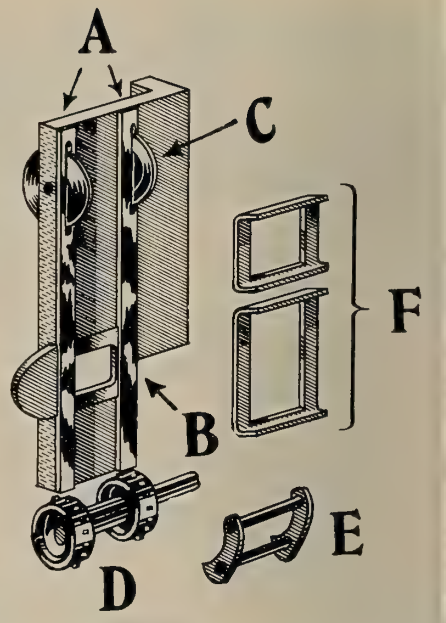


FIG. 2 Component parts of the film gate: *A,* the film runners; *B,* the aperture plate; *C,* the flanged lateral guide rollers; *D,* the intermittent sprocket; *E,* the intermittent-sprocket shoe, and *F,* the gate-tension pads.

soundtrack lies just inside the perforations in the guided-edge margin, so this edge is also guided in the soundhead.

The physical condition of the flanged guide roller is just as important a matter as its lateral positioning. After adjusting the unit laterally and tightening the set screws in the collar so that the picture is properly centered on the screen, make certain that the flanges turn easily. As a matter of fact, the film itself should cause them to revolve slowly. Very light spring pressure, cleanliness, and one small drop of oil will insure their turning.

Failure of the flanges to revolve will result in scoring by the film. A scored flange may shear the edges of the film, tear weak splices apart, and cause severe sidesway of the projected picture. Sidesway and picture-weaving are also caused by spring tension great enough to "pinch" and buckle the film as it enters the gate. Test the degree of pressure with your finger and observe the behavior of the film as it passes from the upper loop into the gate, *and remember that the CinemaScope anamorphic lens doubles the amount of sidesway.*

Why "Studio Guide Rails"?

Several modern projectors are fitted with "studio guide rails" in the gate, for what purpose we know not. Release prints vary in width because of shrinkage: an edge-to-edge distance

between the guide rails just sufficient to clear new unshrunken film will fail to edge-guide seasoned prints, but may sometimes cause them to "bounce" sharply from side to side. This distressing effect is often so evident in CinemaScope showings that one can almost guess what make and model of projector is being used! Set these rails as far apart as they will go, or, still better, discard them if possible.

2. The condition of the gate film runners has a *tremendous* effect upon focus and film buckling. Even though made of hardened steel, the film runners gradually lose their flatness by becoming hollowed out at those points where the friction of the film exerts the most wear. A hollow only a few thousandths of an inch in depth may buckle the film out of shape enough to throw one corner or one side of the picture (usually the right-hand side on the screen) perceptibly out of focus.

Using a short steel straight edge and a small flashlight, check the flatness of your film runners before blaming the lens for that fuzzy upper or lower right-hand corner of the picture!

3. The tension of the gate-door pressure pads is important to the rock-steadiness of the picture. Replace worn pads (which wear hollows in the film runners) and test their tension before blaming the intermittent movement for a jiggly, fluttery picture!

Remove the gate door from the machine and thoroughly clean the pads before adjusting their pressure. Accumulations of film dust and linty dirt are often found lodged behind them. Then press upon the pads with a finger to find out if the pressure is the same on both sides—it should be, as you know.

The writer personally believes that the set of pads directly over the aperture should exert a somewhat greater pressure on the film than the upper set of pads. In other words, if you are using a total of 10 ounces of pressure, the lower set of pads should exert about 6 ounces, and the upper set 4.

Notes on Gate Tension

To obtain an accurate estimate of total gate tension, attach a spring scale (the kind used by rag buyers) to a foot length of clean black-and-white film. Remove the upper magazine and fire-roller box, place the film in the gate (clearing the intermittent sprocket), and pull it *slowly* upward through the gate by means of the attached spring scale. The scale will then register the gate pressure, which should be between 6 and 18 ounces for the best results and minimum film wear.

The highest allowable pressure (15-18 oz.) need be used only in theatres showing mostly old, well-seasoned prints. The lowest feasible pressure (6-7 oz.) is to minimize "sticking" of freshly processed "green" film. An average pressure of 10 ounces (9-11 oz.) is best for the large majority of theatres.

The newer projectors have simplified pad-pressure controls which permit the pressure to be varied during projection. Readjustment of pad pressure is somewhat troublesome on the older projectors, but well worth the time taken to accomplish it. Observe the following precautions, however. (1) Have a few extra leaf-type pad tension springs on hand to avoid an emergency in case of accidental breakage. (2) Have *the same* tension on both sides of the gate. (3) Avoid excessive tension which wears both the film perforations and the teeth of the intermittent sprocket.

4. The aperture, itself, affects only the optical "framing" of the picture, and has no effect upon the film or its movement through the gate. We may therefore pass over this item for the present with the reminder to keep all aperture plates clean and free from dirt which shows up on the screen

(*Continued on page* 22)

Tape Recording, Reproduction

THERE exist in the minds of those who do not work with the medium numerous misconceptions as to the manner in which magnetic tape is recorded and reproduced. Here are the basic facts as to the "how" and "why" of the process.

Every picture is made up of lights and shades, that is, areas of high and low brightness. In television the scene is "scanned," meaning that narrow horizontal lines across the picture are systematically examined from left to right. At each point of the line the brightness of the picture is determined.

The signal obtained by scanning a line is therefore nothing more than a record of the brightness across the line. And if the lines of the *entire* picture are scanned or examined one after another from top to bottom, the resulting signals are a record of the entire picture. It is these signals which must be permanently recorded and then played back to reproduce the original picture on a TV receiver.

Record One of Varying Magnetization

For magnetic tape recording, a TV camera is used to get these brightness signals from the original scene. Then the signals are recorded on moving magnetic tape. As is well known, tape records are nothing more than lines of changing magnetization of the tape, that is, the recording head creates very tiny magnets in the tape material. The strength of these magnets is the record of the corresponding brightness of the picture lines.

Then the reproducing head, passing along these same lines, has voltage and currents induced in it by the tiny magnets on the tape, and these currents are again related to the original brightnesses (or "video" signals).

Thus a videotape record is a record in the form of tiny magnets created in lines on the tape. These magnets, then, represent the brightnesses of the picture, and from them it is possible to recreate the original brightness signals and thus to produce again the original television picture picked up by the TV camera.

Note, therefore, that for videotape recording one must have a TV camera (for pickup and recording) and a TV receiver and picture tube (for display of the picture). In addition, the tape recorder must be provided with a magnetic recording head to make the record, and also a tape reproducing head to "read" the tape record. In a way, this resembles sound or audio-tape recording except that picture brightness instead of sound intensity is recorded.

The author, member of IA Local 165, Hollywood.

Projection Procedures in a Film Processing Laboratory

By DON V. KLOEPFEL

Projection Supervisor, General Film Laboratories, Hollywood

Quality production and adequate service facilities are essential requirements in a film processing laboratory. Projection is a key operation in both quality control and good customer relations through service.

THE fundamental purpose of projection in a film laboratory is to screen motion pictures under known and controlled conditions for analysis and correction by the laboratory staff and final acceptance by the customer.

The duty of the projection supervisor and his staff is to design and maintain such unusual projection equipment as may be required. He is responsible for the purchase of supplies and equipment, and supervises the entire projection operation throughout the plant. This includes the management and operation of projection facilities maintained as a service and convenience to laboratory customers.

While conditions under which a customer views his finished picture duplicate optimum theatre conditions, those requiring film analysis and correction at various stages during the laboratory process are quite different and offer an interesting challenge. Inspection by projection may reveal all kinds of defects or errors that could occur during photography as well as mechanical defects or human errors that can and do arise in any work as exacting and complicated as film processing. After corrective measures have been taken, projection again must be employed to check the correction, and prove that the defect has been eliminated.

Projection of "Rushes"

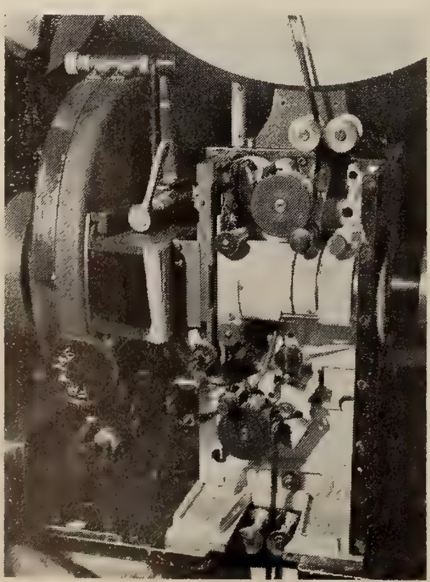
Camera negative delivered to the laboratory late in the day is developed and printed during the night. Next morning the prints, called "dailies" or "rushes," are projected for laboratory officials and customers' representatives.

The film has been processed to a known gamma (roughly the ratio of density to exposure) and is projected at a known brightness level. This early morning projection of dailies is a source of much-wanted information. It is a check on set lighting, picture composition, and the condition of cameras and other photographic equipment. It is a check, too, on the laboratory process.

Virtually all camera negative is processed for dailies. The volume runs into hundreds of thousands of feet per day. To view all this film at 90 feet per minute on ordinary projection equipment would require either a lot of time or a lot of equipment.

To speed up the process so that viewing is within the realm of economical operation, General Film Laboratory's projection department devised the special projector shown in Fig. 1. Standard Simplex projectors were converted to high-speed operation by replacing the one-pin intermittent cam with a two-pin job. With this arrangement, two pull-downs are effected during each cam revolution, rather than one. The feed and take-up sprockets were replaced with 32-tooth sprockets, and minor pad roller and gate alterations completed the design.

FIGURE 1.



Variable transformers are used for screen brightness control, and the lamps are pre-heated. Such projectors are operated at 180 feet per minute, and in some applications as high as 265 feet per minute. Experienced viewers can spot defects at this speed and later analyze the problem at lower speeds if necessary.

16-mm Production Inspection

35-mm negative is used for most Hollywood motion picture production, including theatrical, television and commercial shows. Wide-screen processes have occasioned the use of a larger negative, and surely there is merit in photographing on a large negative for ultimate screening on wide screens. Conjecture relative to such processes, however, is not within the scope of this article.

In the field of visual education, commercial pictures and, to a large extent, television shows, the release is in the form of 16-mm prints. Here too, there is merit in photographing on a 35-mm negative for subsequent reduction to a 16-mm positive for projection.

35-mm film has long been the standard size for Hollywood production. Equipment designed for its use and the technique of workers has reached a high state of perfection. Cameras, lenses, camera dollies and cranes, staging equipment, developers, printers, and all associated equipment has developed greatly through the use of a standard size film. A producer uti-

lizing the 35-mm technique all through his production up to the final 16-mm release prints takes advantage of these improvements.

The 35-32 Production Method

General Film Laboratories processes millions of feet of 16-mm film by what is known as the "35-32" method. A special film 35-mm wide but perforated with 16-mm perforations is used as print stock on which two paths of 16-mm images are printed by reduction printing from the 35-mm negative (Fig. 2).

After developing, this film is inspected on projectors similar to the high-speed machines mentioned previously, but using 12-tooth, 16-mm sprockets and a single pin cam. The aperture is cut out to reveal three frames of 16-mm film and the pull-down is three frames at a time. The speed is 80 feet per minute. Using this method, and viewing both paths, two and one-half hours of television shows can be viewed in about 13 minutes.

Film that passes this inspection is then slit into standard 16-mm widths and checked for sound on Bell and Howell 16-mm sound projectors. Customers' screening rooms are equipped with Eastman Model 25 16-mm projectors.

Projecting Unwaxed Film

From the original negative, a print is made on fine-grain positive printing stock. From this fine-grain positive a duplicate negative is made and subsequent printing is done from this "dupe," so that the original negative is protected. Should a defect show up in a print made in this manner, a search may have to be made to find just where in the entire process the

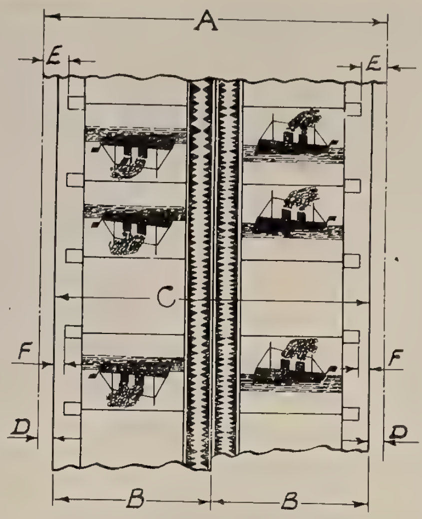


FIGURE 2 — CODE:
A: 35-mm — 1.377
B: 16-mm — 0.629
C: 32-mm — 1.258

Edge Perf. D: 1½-mm — 0.060
E: 35-32 — 0.096

F: 16 Perf. — 0.036
Edge Distance

defect originated. It may be necessary, in the interest of speed, to project the fine-grain, the dupe negative or, with the producer's approval, even the original negative.

All of this film must be completely protected from physical damage or dirt. It is not usually waxed or coated. To project it without damage, projectors with special rails, guides and pressure pads have been devised.

A time-honored method is to cover existing rails with felt strips, and make pressure pads of felt. Various light woods have been used. These are usually impregnated with some anti-friction material such as silicones, graphite, etc. During the past year our experiments with "Teflon," in various forms, have been quite interesting. Thin Teflon strips cemented to milled-down rails proved to be the most practical method of using this material. A tendency to "flow" or mash out under the pressure pads makes replacement necessary after about 250 hours of operation.

When making a print from a color negative, a system of color filters and print light intensities is used to balance scenes and obtain the best print quality. The process of selecting the proper filters and lights is called "color-timing." A majority of 16-mm projectors use tungsten light sources, and the laboratory takes this fact into account when it times the color prints.

Color Film Viewing

A 16-mm color film made from a 35-mm color negative by reduction printing requires the use of a different correction filter, because of the usual tungsten projection light source, than would a 35-mm contact print which is normally projected with arc light.

If a reduction 35-32 color print and a 35-mm color print of the same subject were projected side by side with the viewing machines previously described, the 35-32 print would appear to be in proper color balance, while the 35-mm print would appear to be on the yellow side because the light

FIGURE 3.

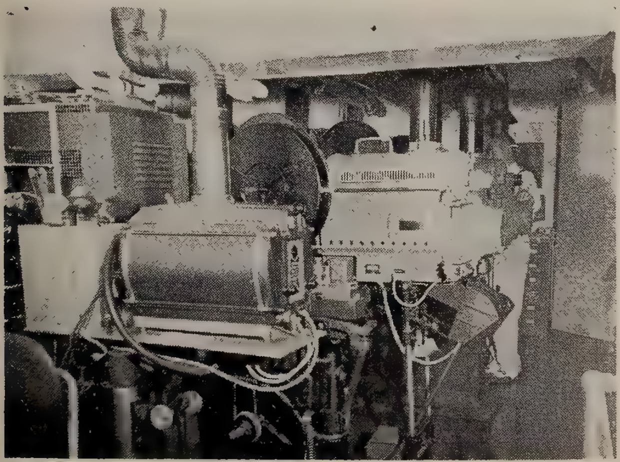
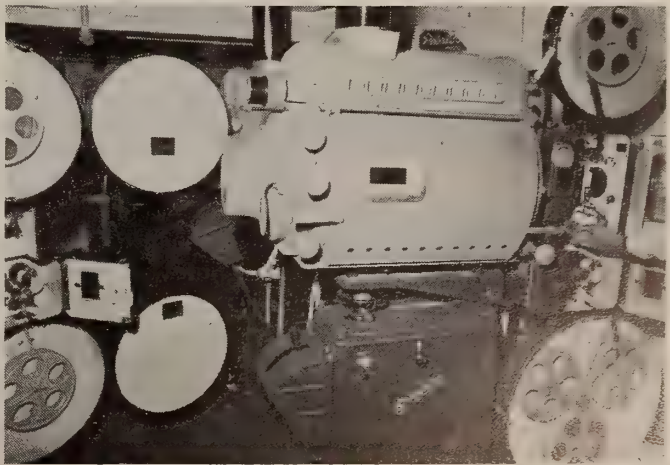


FIGURE 4.



source of both projectors is tungsten. An approximate correction can be made in this case by filtering the projected light from the 35-mm viewing machine.

Eastman Kodak suggests that a print originally color-timed for arc light projection, but projected with a tungsten source, can be corrected approximately with a combination of a Kodak Wratten filter No. 78B and a Kodak compensating filter CC-05G. A print which was originally color-timed for tungsten projection but projected with arc light may be corrected approximately with a combination of a Kodak Wratten filter No. 86A and a Kodak compensating filter CC-05M.

Projection Services

All of the equipment thus far described is basically used for quality control. In addition to quality control, the next important function of the Projection Department is to provide services for the convenience of Laboratory customers. General provides these projection services:

(1) Projection of 35-mm or 16-mm television or screen prints.

(2) Closed-circuit television viewing of 35-mm or 16-mm TV commercials, pilots and shows.

(3) Trade or press showings at any aspect ratio for theatrical pictures.

(4) Editorial or cutting screenings with silent picture, or with composite track or with separate optical or magnetic tracks.

(5) High-speed inspection of stock or cut picture.

(6) Editing, pre-scoring or pre-dubbing screenings with as many as four separate optical or magnetic tracks.

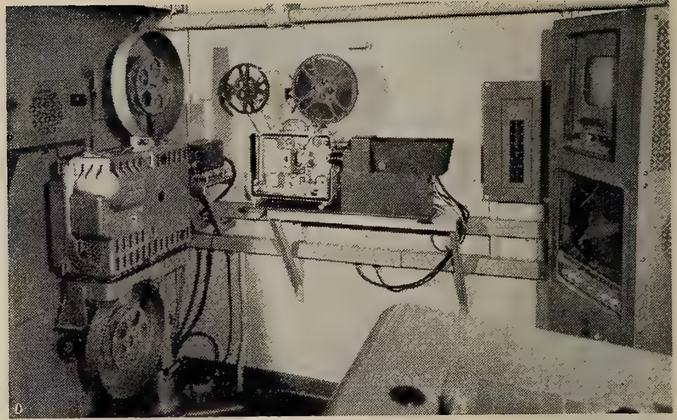
(7) 16-mm trade or press screenings.

Complete Screening Room

A multi-purpose installation is shown in Fig. 3. A pair of Simplex X-L projector mechanisms with Magnarc lamps, Simplex soundheads and Altec sound and auxiliary equipment provide the usual screening services. Two sound track reproducers, an electrical interlock system, and a mixing rack in the auditorium make possible the screening of a picture with as many as four separate optical or magnetic sound tracks.

Such an installation is of great value to the film editor or producer. In a Western, for example, there may be a dialogue track, a gunshot track, a hoofbeat track and an Indian war-whoop track. The editor has cut these tracks and spliced in the leader so that the effects and dialogue occur at the proper time to be in synchronism with the picture. All these tracks and the picture are threaded on start marks put on by the editor, and all pieces of equipment are rolled simultaneously by means of electrically-interlocked motors.

FIGURE 5



Should any track be out of sync or cued improperly, the mistake can be remedied before the "dubbing" session at the recording studio, when all tracks are recorded together in a composite track. A delay during dubbing involves tying up highly paid recording crews and expensive equipment. This pre-dubbing service has proved to be very popular with General's customers. A projector and a sound reproducer set up to run in interlock are shown in Fig. 4. Note the control above the sight box. It operates a variable diaphragm or vane in the light beam which varies screen brightness so that pictures of any aspect ratio can be projected at the Academy standard brightness level.

A high-speed silent projector which operates at 265 feet per minute, and a 16-mm arc projector share a third port in this room. These units are mounted on casters and all service is plug-in. The 16-mm arc projector uses the existing Altec sound system and horns.

Television Film Equipment

A modern film processing laboratory would not be complete without means of viewing films made for television on a television tube. General's equipment includes two complete closed-circuit TV film chains.

When discussing the projection of motion pictures into a TV camera for televising, the term "field" frequency is used rather than the more familiar "frame" frequency reference in motion pictures. The number of "fields" or flashes of picture projected per second is the "field" frequency per second.

Sound motion picture speed is usually referred to as 24 frames per second. To refer to fields in this instance would be awkward. A two-blade shutter making 24 revolutions per second would result in a field frequency of 48. A three-blade shutter would have a field frequency of 72 fields per second.

Television engineers, in the beginning, chose 60 fields per second as a field frequency for TV because synchronizing circuits could then be "locked-in" by utilizing the 60-cycle power line frequency most commonly used in the United States.

Obviously, a standard sound projector operating with a field frequency of 48 or 72 cannot be used to project into a TV camera operating at 60 fields per second. The result is shutter bars or black belts across the picture. If the projector was to be operated at 30 frames per second, the field frequency (using a two-blade shutter) would be 60 fields, and would lock in with the camera frequency. But, of course, with sound recorded at 24 frames per second this is not the solution. The problem then, is how to operate at 24 frames per second and project a picture at 60 fields per second, or an even multiple thereof.

Figure 5 is a view of the closed-circuit TV film chain section. The 35-mm projector to the left in the picture uses the ingenious "2-3, 2-3" roller pin intermittent movement. This movement holds every other frame in the aperture one-third longer in time than the preceding one. The two-blade shutter operating at 30 revolutions per second,

(*Continued on page* 20)

AUDIO - VISUAL
EDUCATIONAL • INDUSTRIAL • COMMERCIAL

Ambient Illumination and Projection Light

THE subject of projector lumen requirements is seemingly never exhausted. Occasionally we have discussed the light outputs of 16-mm projectors and gave a table showing the sizes of pictures to be obtained *on the average* for 10 foot-lamberts of screen brightness with bulbs and arcs of different powers. (10 foot-lamberts is the *professional* minimum-brightness standard; 20 is common in theatres, and 5 is acceptable in 16-mm projection.)

Because motion-picture theatres are reasonably dark during the projection of films, the optimum picture-brightness level can be established within narrow limits for professional projection. A different state of affairs prevails in classroom projection because the room may not be quite dark, and is sometimes deliberately illuminated dimly for purposes of discussion and note-taking. Projection-light requirements vary *enormously* when ambient light falls upon the screen.

Minimum Allowable Brightness

Projection in a totally darkened room is, of course, ideal from the point of view of the projectionist. The theatrical minimum brightness level of 10 foot-lamberts is regarded as extremely desirable in the *dark*-room projection of instructional slides and 16-mm films, while 20 foot-lamberts may be accepted as a practicable maximum.

As a concession to the relatively low illuminating power of most non-theatrical projectors, the minimum allowable picture brightness has been set at 5 foot-lamberts for 16-mm showings.

Projection screens, even the flat-white matte screens, vary in reflective power. A screen which reflected 90% of the light when new may reflect only 80%, or even less, when old or dusty. Unlike indoor-theatre screens, most classroom screens are unperforated, and accordingly have the advantage of an 8% higher reflectance for the same type of surface.

Calculating Light Output

On the basis of an *unperforated* matte-screen reflectivity of 87%, 5, 10, and 20 foot-lamberts of "blank-field" brightness correspond to 5.75, 11.5, and 23 foot-candles of incident projector light measured with a light-meter.

A *lumen* is a unit of light flux, so the number of lumens illuminating a screen is the same as the number of lumens issuing from the lens of a projector. To determine the lumens of light output required of a projector for a given brightness level (foot-lamberts), multiply the area of the screen in square feet by the desired number of foot-lamberts and divide the product by screen reflectance.

$$L = \frac{Ab}{R}$$

As an example, for 10 foot-lamberts on a 4′ x 3′ screen of 0.87 reflectance we need 138 lumens of projection light.

$$L = \frac{12 \times 10}{0.87} = 138.$$

This light-output requirement is satisfied by the average 500-watt 16-mm projector having a 65% shutter transmission and an *F*:1.6 coated lens (approx. 150 lumens), or by a 750-watt machine using an *F*:2.0 coated lens (also approx. 150 lumens).

Manufacturers of both slide and motion-picture projectors are usually willing to furnish lumen-output data for their machines with various bulb, lens, and shutter combinations. (The use of flickerless 3-blade shutters reduces screen illumination about 25% from the level obtained with 2-blade shutters having the same angular width of blade.)

When the level of ambient light falling upon the surface of the screen is high, projection light must be stronger to make the entire range of contrasts and colors of the film and slide pictures visible. As a general rule, the 5-foot-lambert level set forth as a minimum 16-mm picture-brightness level should be applied only to rooms which are almost totally dark.

The preferred 10-foot-lambert level is suitable when the brightness of the ambient light on a matte screen does not exceed 0.1 foot-lambert. (Newspaper headlines set in 1-inch type can be made out only with difficulty under this level of ambient light.)

Ambient Light Factor

Now, to determine the best projection screen brightness under other intensities of ambient illumination, multiply the foot-lamberts of spill-light brightness *at the surface of the matte screen* by 100. Thus for 0.5 foot-lambert of ambient light on the screen, projection-light brightness should be

This 80-foot window-on-the-world is strictly an illusion. It is actually the world's largest color photo—80 feet long and 20 feet high—calculated to bring the warm Pacific breezes from Hawaii's famed Diamond Head into the main ballroom of the Cincinnati Music Hall. Produced by Color Corp. of America (New York and Tampa, Florida) the giant photo-mural was made from a color negative only 825/100,000 the size of the final print.
The picture was so big it had to be mounted in an airplane hangar and required 2550 square feet of photographic paper.

0.5 x 100 = 50 foot-lamberts. (At this level of ambient light, the text of a newspaper may be read with some degree of eyestrain.)

The maximum "dark-room" picture-brightness level of 20 foot-lamberts will tolerate ambient-light levels up to 0.2 foot-lambert, or enough to permit reading newspaper headlines with ease.

It should be noted that "specular," directional screens such as the glass-beaded type tolerate higher levels of ambient light than do flat white matte screens. Very high levels of ambient light do not greatly interfere with picture visibility when translucent rear-projection screens are used. Rear-projection screens require a special technique and the absence of ambient light on the projector side of the screen. These special screens are particularly useful for the exhibition of slides in brightly lighted classrooms.

* * *

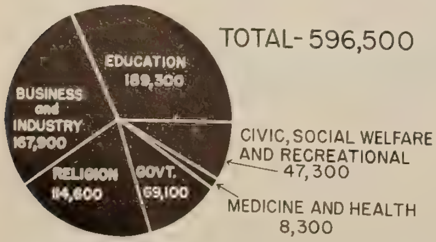
Non-Theatrical Spending $255 Million in 1958

THE PRODUCTION of non-theatrical films and the use of audio-visual equipment is fast becoming one big business. Despite the recession, dollar volume in the visual communication industry last year reached $255 million, according to an article in the June *Journal* of the Society of Motion Picture and Television Engineers (John Flory and Thomas W. Hope, Eastman Kodak Co.). Total dollar investment in films since the end of World War II is more than $2.5 million, the article states.

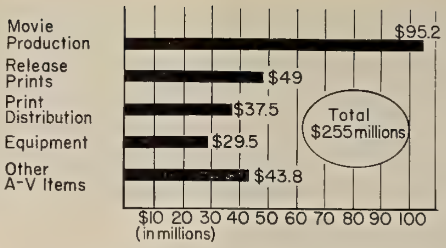
The six major users of non-theatrical films and equipment and their expenditures last year are: (1) business and industry, $150 million; (2) government (federal, state, and local), $48 million; (3) educational groups, $27 million; (4) religious groups, $15 million; (5) civic, social welfare, and recreational groups (fraternal, youth, service, public libraries, etc.) $8 million and (6) medical and health groups, $7 million.

Components of Total

Figures cited are based on motion picture and filmstrip production, release prints, distribution costs, equip-



Distribution of 16-mm sound-film projectors in U.S.A. (1959 estimate).



Breakdown of total expenditures in the A-V field (estimated for 1958).

ment purchases (primarily 16-mm sound projectors), and other audio-visual materials and equipment including filmstrip projectors, 2x2 slides and projectors, which are used professionally; overhead transparencies and projectors, and opaque projectors.

In the over-all audio-visual field, motion picture and filmstrip production is the largest single expenditure, approximately 37 percent of the total. Film production, release prints, and print distribution account for 71 percent of the total.

In all, 7,300 non-theatrical films were produced in 1958. However, this does not include low-cost silent and magnetic-tracked films produced for internal use by industry or some classified government films. Some 6,800 production units turned out the bulk of the non-theatrical films made in the United States last year.

During 1958, 45,000 16-mm sound projectors were sold, an increase of 3½ percent over the previous year. Projectors in use in the United States now number 596,500, with educational groups estimated to have 189,300.

* * *

Nothing's Wrong—Or is It?

WHAT'S WRONG with the A-V field? *NOTHING* that a tiny bit of coordination wouldn't allay, if you "buy" (as you *must*) the appended commentary by a dealer in photo supplies who, apparently is sick-unto-death of the non-standard shenanigans going on in this field. We quote, verbatim from *Photo Weekly*:

"The lack of standards in this field is appalling. Take, for example, the hodgepodge of connecting cords which come with the various types of projectors on the market today, and the scores of different connections to be found on remote-control cables. We have power cords in stock today with ends of every conceivable size and shape. There are flat plugs, round plugs, three-pronged plugs, three-holed plugs, *ad infinitum*.

The problem of cords doesn't begin to come up to the problem of slide magazines. Any dealer with any kind of a stock must now carry $100 worth of magazines just so he will make sure he has a half-dozen of the various types necessary to fit TDC, Airequipt, Kodak, Bausch & Lomb, Revere, Realist, etc! And if you think the dealer is confused, just imagine what it does to the consumer!

Our particular gripe, however, is the location of dates on *sensitized* goods. Some manufacturers keep the expiration dates so well hidden that it takes considerable time just to keep the stock in order so that oldest merchandise will move first.

Boxes of film, boxes of paper, roll film, movie film, and paper packages have expiration dates so well hidden that it is almost impossible to find the expiration date when the stock is properly placed on the shelf; the dates are always in different locations on the boxes!

Consider cut film. On some boxes, the manufacturers put the date on the side; on others, on the back end away from the identification label; on some boxes, it is on the bottom; and every box has to be moved so that the date location can be discovered before new stocks can be put on the shelves.

It's about time that we had some STANDARDS in this business. WILLIAM C. McCLANAHAN, Photo Supply Dealer, Lake Charles, Louisiana.

* * *

Kodak 8-mm Film Booklets

HOW TO GET more mileage — and smileage — from 8-mm movies are topics of two booklets available now for the non-professional movie-maker from Eastman Kodak. The publications, "Getting The Most Out Of Your 8-mm Films" and "Care of Processed 8-mm Kodachrome Movies," provide an easy-to-understand primer on Kodachrome movie films, exposure guides, magazine and roll film loading, splicing, cleaning and lubricating, and storage.

The current edition of "Getting The Most . . ." is a revision of an earlier publication. It provides information on the structure of 8mm films, exposure aids, and data on obtaining Kodachrome Duplicates, a service unavailable when the first edition was published.

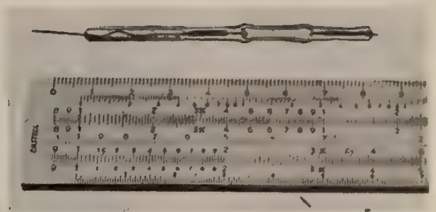
Care of Processed Movies

"Care of Processed . . . Movies," a six-page pamphlet, is a new publication. It opens with nine suggestions to prolong film life. They include cleaning parts of the projector which are in contact with the film, repairing the films themselves, careful splicing, long leaders and trailers, proper reel

(*Continued on page* 18)

More on New Projection Light Source: Philips' SPP Discharge Lamp

First publication anywhere in the world of detailed data anent the Philips SPP radically new projection light source appeared in IP for November last (Vol. 33, No. 11, p. 8, *et seq.*). Additional specific information relating thereto is appended, culled from the report of the Progress Committee of the Society of Motion Picture and Television Engineers as published in its Journal for May, 1959 (Vol. 68, No. 5, p. 310).



The Philips SPP discharge lamp, shown here with holder, is only 3¼" wide, ¼" in diameter.

THE Philips gas-discharge lamp SPP consists of a quartz tube 3 1/4 inches in length and a maximum diameter of 1/4 inch, which makes an extremely small lamp. The discharge takes place inside a thin capillary tube with an arc length of about 2/3 inch.

For film projection the lamp is driven by a pulsating direct current of 72 pulses per second or 3 pulses per frame. Light is produced only during these current impulses; in the intervals the lamp is dark. This lamp finally fulfills the old dream of cinema technicians: to be able to produce light only as long as it is necessary for actual projection, thus cutting the losses caused by the rotary shutter.

SPP lamp can be loaded up to 800 watts. The average life of this inexpensive lamp is 33 working hours under full load. At lower loads, however, the working life is considerably extended.

Spectral-Energy Distribution

Unlike the incandescent lamp or the carbon arc, the luminous flux decreases no more than proportionally with the load, so that the luminous efficiency remains equally high. The extremely high current intensity during the impulse peaks at which values 10 times the mean value are reached, leads to a continuously uniform spectral-energy distribution, permitting excellent projection of color film.

Both according to the way it is produced and to its spectral distribution, the SPP light can be classified as "cold", thus the film is hardly heated. Ultraviolet radiation is eliminated by an absorption filter contained in the lamp holder.

The luminous flux of each individual lamp remains constant throughout its life. Only just before its ultimate breakdown the luminous flux shows a pronounced deterioration. The excellent properties of this gas-discharge lamp can only be fully utilized in a specially designed, shutterless projector. A brief description of the working of the lamp and how it is utilized in the projector follows.

Side-to-Center Distribution

Since the lamp is small and may be placed without any risk in the immediate vicinity of the picture gate, its optical system can likewise be small. It consists of a cylindrical reflector not larger than 1/2 inch by 1/3 inch and two lenses, which form an image of the discharge in the objective lens. This explains the exceptionally high side-to-center ratio of 95%. Every frame of the film receives three flashes when stationary.

Even for a high picture brightness the screen image shows no trace of flicker. The film is moved up while the lamp is completely dark. A projector equipped with this lamp accordingly does not require a rotary shutter and all light produced is completely utilized for projection.

The SPP lamp operated at 800 watts produces the same luminous flux on the screen as a high-intensity arclamp at a current of 60 amperes. The screen sizes attainable on a matte-white projection screen with a reflection factor of 0.8, on a screen with an average angle of vision with a reflection factor of 1.8, and on a narrow-angle screen with a reflection factor of 3.0 with the aid of a projection lens of F:1.8, are given in the accompanying table. Strongly reflecting screens, e.g., beaded screens, owing to their narrow angle of vision, are obviously unsuitable for large theatres. This should be kept in mind when consulting the table.

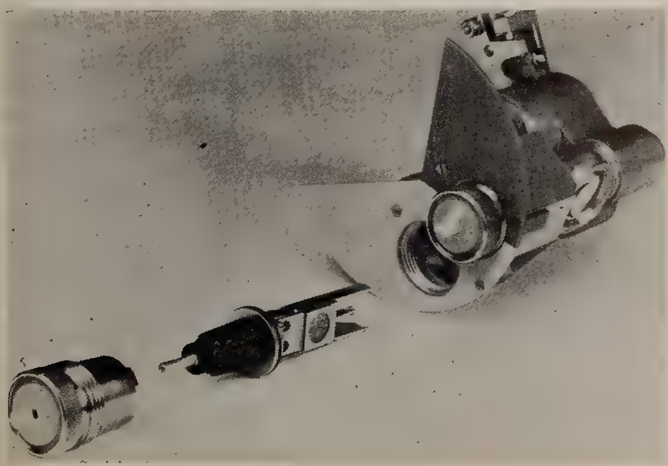
MAXIMUM SCREEN SIZE (FT.) FOR STANDARD LUMINOUS INTENSITY

ASPECT RATIO:		Standard 1:1.37	Wide Screen 1:1.85	CinemaScope 1:2.34
Matte-White	0.8	24 X 19	26 X 14	34.5 X 14.7
Average Angle of Vision	1.8	39.5 X 28.8	39.5 X 21.3	52.5 X 22.3
Narrow Angle of Vision	3.0	52.5 X 38	52.5 X 28.3	62 X 28.5

Semi-Automatic Operation

Particular attention should be drawn to the uniform illumination of the screen. Whereas for carbon-arc projection a side-to-center ratio of 75%, and for xenon projection an even lower ratio is considered permissable, the side-to-center ratio with SPP projection for both left- and right-hand edges is at least 95%.

Operation of the SPP lamp is confined to switching on and off insofar as this is not automatically effected by the projector. When used, it does not produce any dust or noxious fumes, hence requires no ventilating device. It can readily be operated by any automatic device. It is so small that it can be mounted together with a spare lamp and automatic changeover device in the projector.



The Philips SPP discharge lamp is shown here in its housing, together with the turret carrying a spare lamp which by a simple turn provides for instantaneous replacement.

2000th Kodak Research Paper Caps 47 Years of Photographic Progress

By GLENN E. MATTHEWS

Member, Eastman Kodak Research Laboratories

IN the broad sweep of photographic progress a milestone was reached recently with the issuance of the 2000th scientific paper from the Research Laboratories of Eastman Kodak Co. Over a span of 47 years, the papers have chronicled an extensive record of significant additions to the world's knowledge of photography, including such things as the nature of photo-sensitivity, the theory of how the tones of a photograph are formed from millions of tiny silver threads, and the complex chemistry that lies behind the deceptive simplicity of color photography.

Report No. 2000 concerns a new technique for exposure of a single, tiny silver-bromide crystal to an electrical field and to an amazingly brief flash of light—one ten-millionth of a second. The paper explains how by carefully controlling the time between the application of the field and the light exposure, and by use of an electron microscope for tremendous magnification, the reaction time for the photo-chemical process for one emulsion has been found to be only one-millionth of a second—much shorter than previously believed.

Scientists Respect Reports

Dr. Cyril J. Staud, in charge of research, sees the papers as a record of progress based on original scientific work toward a main objective of increasing understanding of photographic science. "The 2000 carefully compiled research reports form an important part of the body of Kodak's photographic knowledge," he said. "Beyond this, they are significant additions to the literature of science."

Dr. Staud drew a comparison between the flow of scientific detail and new theory in the papers and Kodak's recognized service to science in supplying nearly 4000 organic chemicals to the nation's research laboratories and provision of more than 100 different types of special photographic plates for spectroscopists and astronomers.

Kodak Research Laboratories, established in 1912, was one of the first such in the United States to do *basic* research. The first laboratory communication, published in the *Philosophical Magazine* of London in 1913, discussed the absorption of light in materials such as photographic emulsions, glass, and other media. Since then the reports have appeared in 201 scientific journals around the world, including 47 published in French, German, Italian, Japanese, or Chinese.

When Light Strikes Film

The secrets of the invisible change caused by light striking a photographic emulsion are the subject of an important group of the 2000 papers. Even the earliest wet-plate photographers were interested in how the hidden "latent image" is formed. Some technical men have called it one of the most elusive of scientific questions.

As latent-image formation is understood today, incoming light frees electrons that move about in a silver-halide crystal and finally combine with silver

Now It's "Cinetarium," 360° Surround Film

CINETARIUM is a new way of taking and projecting a 360-degree circular motion picture using only one camera and one projector. Adalbert Baltes, a German film producer with studios in Hamburg, developed the process during the past 11 years as a result of continuing experimentation with prisms.

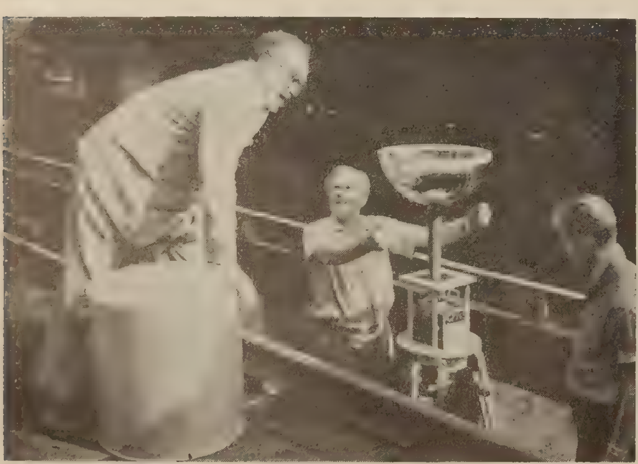
In front of an ordinary camera operating in the vertical direction a reflecting sphere or hemisphere is mounted. The image on the hemispherical mirror is photographed and produces a circular picture on the film. For projection a conventional projector is used, the light beam being vertically directed onto a hemisphere, for instance by means of a mirror.

From this the picture is reflected onto a hemispherical all-around screen or on an all-around screen of a certain width, comparable for instance with a Circarama screen as used by Walt Disney.

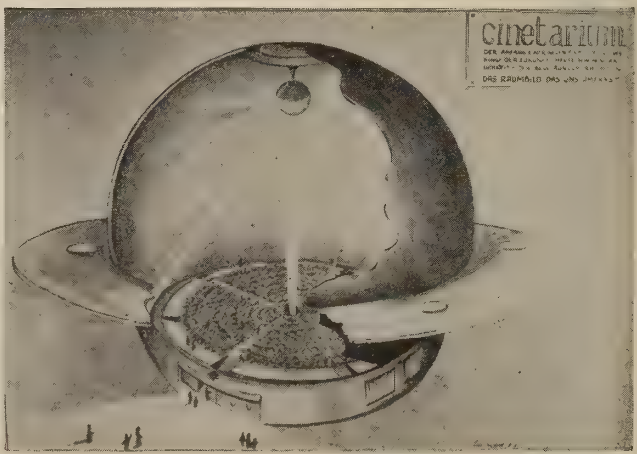
The great difference betwen these two systems lies in the fact that the Circarama picture consists of 11 projectors and 11 separate screens due to the necessity of using just that many cameras and films with more or less visible seams. The Cinetarium picture is produced with one camera on one film and projected the same way and therefore has no seams at all and can obtain a picture on a fully hemispherical screen-surface.

This system was demonstrated at the Photokina 1958 Exhibition in Cologne, Germany, in a viewing room with a diameter of approximately 46 feet. Cinetarium Film Corp. of America plans its first showing of the process at the Pan American games in Chicago this summer.

Progress Report for 1958, Society of Motion Picture & Television Engineers



Camera in position for a Cinetarium shot. The hemispherical mirror is seen above the camera lens.



Proposal for the exhibition of Cinetarium pictures. Fanciful? Maybe; but don't forget Disney's Circarama.

Photos by courtesy of Society of Motion Picture & Television Engineers

ions to produce atoms of silver. When several of these form at the same location, the cluster of silver atoms becomes large enough to *trigger* the development of the *entire* crystal when placed in developer.

Earlier research built toward this understanding by presenting the idea that there were favorable locations in a crystal where the effects of light were concentrated. When this was supported by a concept of electron motion in solids, it led to experimentation involving controlled exposures under varied temperatures, and to a theory of sensitivity-centers involving trapped electrons.

[TO BE CONTINUED]

Is Poor Projection What's Wrong With This Business?

Answering the heading, we append verbatim an item from our esteemed contemporary (we mean it)* The Film Daily. *These exhibitors are the guys who now want to have their projection facilities surveyed (for free) and order no new equipment.—ED.

ST. LOUIS.—Triple features are appearing on the St. Louis territory scene. The Mid-America Drive-In Theatres, operated by the Jablonow-Komm interests, including the Holiday, at Overland, Mo.; the Thunderbird at Natural Bridge; the Plaza, St. Charles, Mo., and The Shop City, East St. Louis, Ill., day-and-dated the St. Louis area first-run showing of "Born Reckless," plus "Island of Lost Women," with the third picture "The Young Land," at the Holiday, Plaza, and Thunderbird; while Shop City had "My Gun is Quick."

Meanwhile the circuit's Bell-Air Drive-In near Granite City is playing "The Ten Commandments" and Walt Disney's "Pecos Bill" at popular prices.

Projection Calculator Is Offered Free by Strong

A calculator which determines the type of projection lighting which should be used by a specific theatre has been developed by The Strong Electric Corp. It is based on a minimum light requirement at the screen of 4 foot-lamberts for drive-ins, and a value of 14 foot-lamberts for indoor theatres with standard aperture and with shutter running.

Only by meeting these minimum requirements are good projection and bright pictures made possible.

The calculator, which is used by turning a dial card, has provisions for use by indoor theatres and drive-ins with high gain or matte screens of all widths. One of these calculators will be sent free to anyone addressing a request to Strong Electric Corp., 31 City Park Ave., Toledo 1, Ohio.

AUDIO VISUAL

(*Continued from page 14*)

loading, bent reels, cleaning and lubrication, rewinding, and storage.

An illustrated section on splicing outlines use of the Kodak Presstape Movie Splicer (8-mm and 16-mm), a dry splicer which uses pressure-sensitive adhesive tape. Both booklets are available free on request from the Sales Service Division, Eastman Kodak Co., Rochester 4, New York.

* * *

1200 A-V Aids in WCOTP Splendid New Volume

WITHOUT BUDGING from their seats, students can peek inside the Kremlin, visit a Spanish bullfight, explore a jungle in Peru, go whale hunting off the Norwegian coast, or listen to a Hungarian rhapsody—all through the use of films and records in the classroom. A catalogue of over 1200 films, film strips, slides, and records available to teachers has just been published by the World Confederation of Organizations of the Teaching Profession (WCOTP) in a volume entitled "Audio-Visual Aids for International Understanding."

The historical and cultural films included were recommended by teachers, diplomatic sources, and scholars for their accuracy and objectivity. Representing 40 countries, they form the most comprehensive listing of this kind ever published. Research for the project took more than a year. The descriptions include title, content, language, length of time, educational level, source, and price.

Copies of the new volume, which can be converted into a card file system, are available for $2.50 each pre-paid from WCOTP, 1227 16th St. N.W., Washington 6, D. C. WCOTP is a confederation of 3½ million teachers in 70 countries. N. E. A. representing U. S. teachers, is the largest affiliate.

* * *

New Sylvania C-C Camera

SYLVANIA ELECTRIC PRODUCTS, Inc. has announced that its new closed-circuit television camera will carry a manufacturer's suggested list price of $545. Volume production of the Vidicon-type camera, which weighs only 15 pounds, will be attained shortly.

The camera requires no special lighting and will transmit an image on any selected channel from 2 thru 6 to any standard, home-type receiver. It is equipped with a turret mount to accommodate three different lenses but will be sold with one, two, or three lenses as required. Sylvania also will offer a matching 17-inch monitor at a suggested list price of $175.

The Sylvania system employs simplified controls and can be operated by a layman from printed instructions. The camera construction is simplified and service can be performed by regularly trained TV receiver technicians.

Technicians Spurned—Frayne

The motion picture industry in all its branches has been cautioned to reconsider the past contributions as well as the future potential of its technicians by Dr. John G. Frayne, retiring engineering manager of Westrex Corp.

Frayne declared that the industry now feels that it can dispense with the services of technicians and engineers who have contributed invaluable services in improving the quality of film production during the past decade. "It is now more important than ever that engineering progress be encouraged," he said.

Frayne is a past president of the Society of Motion Picture and Television Engineers.

The Eastman Kodak Saga

A person who purchased one share of Kodak common stock in 1884 (about $100), through stock splits and stock dividends and distributions, would now own 5842 shares of Kodak common stock worth more than $528,000 at current market prices. Assumed in this figure is that *none* of the cash dividends paid over the years was reinvested in Kodak stock.

Since 1902 Kodak has paid 228 consecutive cash dividends which would have totaled over $153,000 on the stock resulting from the one share purchased in 1884.

During the past 79 years Kodak has progressed from a one-man operation (George Eastman) into a company employing 70,000 people world-wide, with 10,000 suppliers and 100,000 shareholders. It maintains sales, distribution, and photo-processing establishments in some 250 locations throughout the world.

The company's net assets have grown from $6.4 million in 1901 to $631.1 million at the end of 1958. *Net* earnings of $98.9 million last year were almost 40 times the $2.5 million earned in 1901.

Movie Attendance Up Sharply

Film attendance continues to be up sharply over last year, reports Sindlinger & Co., business analysts. "The current climb began in mid-February, ending a 10-year decline experienced by the motion picture industry," the report stated, "with attendance during the week of May 30 being 15.4% over the same period last year." During that week, Sindlinger reports show that 44.2 million persons (12 years and older) attended the movies.

Significant portion of the report is confirmation of the fact that thousands of people who haven't been in a movie house in years are now reacquiring the habit.

Bad News For Officials: Don't Want 'em There

Shareholders in American industry will participate in their respective companies' annual meetings on a much broader scale in the very near future, according to a communications specialist. And what's more, these shareholders will not have to travel thousands of miles—to sit in on a meeting and to hear and question corporation officers on present and future company policies.

Closed-circuit TV is the medium which, by virtue of large, wide screens and direct two-way speaker hook-ups, is going to make increased millions of American stockholders more actively share in the administration of their companies.—TelePrompTer Corp.

Who Remembers When?

THE article on page 15 of the August IP relative to non-intermittent projectors rang a bell in the back of my head and led me to dig out my files the old *American Projectionist* magazine and start hunting. In the issue of September, 1926, I found a picture of Mr. Emil Mechau on the cover and an article on page 4 with the heading: "Mechau Non-Intermittent Projector Is Optical Masterpiece—Newest German Importation Is Flickerless and Rock-Steady."

This article, mentioning its installation at the Capitol Theatre, New York, quoted Art Smith, chief projectionist, as saying: "I believe these projectors are a big step in advance of any that I know." The article contains an excellent description of the projector and has several explanatory diagrams. There is also an excellent photograph of the projector itself which seems essentially like the one in the August IP thirty-three years later.

Can You Match This?

In the course of reading this old article, I faintly remembered an account of another non-intermittent projector; and after going back still farther in the files, came up with the June, 1923, issue of the same magazine. On the cover is a photograph of a Mr. S. Bardy standing beside the "Bardy Continuous Projector." On pages 4 and 5 is the reprint of a lecture given by Mr. Bardy before the American Projection Society in May, 1923, relative to the merits of his projector.

I am glad to have been brought up to date on the Mechau in the August IP. Does anyone recall what was the fate of the Bardy projector?

By way of identifying myself, may I say that I was a projectionist back in central Indiana for a number of years, but since 1936 have been a member of the faculties of Pomona College and Claremont Graduate School, two of the five Associated Colleges in Claremont, California. Because of my acquaintance with the projection field, I was asked to take charge of the major installations of projection equipment among the various colleges (16-mm and 35-mm motion picture and various types of still projectors). I teach Audio Visual Education in the Graduate School and music theory at Pomona College.

I have been greatly impressed with IP's expanding Audio-Visual department, and I make it a point to urge teachers using audio-visual aids to subscribe to IP for the very fine articles in this field. Keep up the good work.

Incidently, when I get to feeling nostalgic about the good old "silent" days, I go out to my garage and run a reel or two on an old Model 1-A Motiograph which is one of my prize possessions.

WILLIAM G. BLANCHARD

Claremont Graduate School,
Claremont, Calif.

PROJECTION PROCEDURES

(*Continued from page* 12)

scans one frame twice and the next frame three times. The result is 60 scans per second and the 24 frames per second film has been transformed into a 60 fields per second TV picture. The camera output is fed to the top monitor unit in the rack (right) and to receivers in the auditorium.

The Bell and Howell JAN model 16-mm projector (center) is also converted to the TV scanning rate. In this case the conversion is much simpler. The pull-down period is fast enough to occur during the closed period of the shutter even though the shutter is running at 60 revolutions per second. The result is a field frequency of 120 fields per second or five fields per frame. Both projectors, of course, have synchronous motors.

The output of the camera seen in front of the JAN projector is fed to the lower monitor in the control rack,

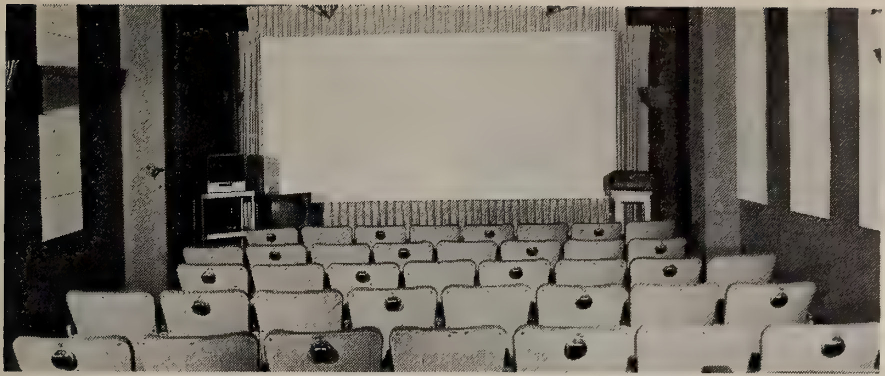


FIGURE 6.

and from there to receivers in the theatre auditoriums. Fig. 6 is a view of one such auditorium, with two TV receivers near the front. The device to the left of the screen is an all-electronic footage and scene counter. Because this counter contains no moving parts, it is completely silent. Note the flat screen.

Projection Department Duties

The function of a laboratory projection department is to furnish complete projection services as an aid to quality control, and as a convenience and service to laboratory customers. To do this effectively, the projection supervisor and his staff must be thoroughly aware of the requirements of the laboratory and understand its operation. The supervisor must be prepared to design or supervise the design of unusual projection equipment, be familiar with accepted and proposed standards, and have a wide acquaintance with manufacturers and suppliers of projection and processing equipment. He should be as active in his local Union's affairs as possible, belong to the Society of Motion Picture and Television Engineers, The Motion Picture Research Council, and other technical societies, and attend meetings, forums, seminars and, if possible, University extension courses in his field. His reading habits must include SMPTE Journals, and above all his only trade paper, INTERNATIONAL PROJECTIONIST.

Because laboratory projectionists are in close contact with motion picture producers, stars, directors and editors as well as laboratory officials, they must understand the problems of these creative people and the tensions to which they are subjected. For some, a particular screening may be the fruition of months or even years of effort. It may represent a sizeable part of their fortune, their future and their reputation. Under such pressure, they may be difficult to work with at times.

A capable projectionist politely and competently follows what may seem to be unnecessary instructions. He will understand that framing can determine if an almost invisible hair is in the projector aperture or was introduced in some other piece of equipment. He knows that focusing is a check on camera and printer as well as projector, and he knows that a dark scene can be caused by something other than a faulty arclamp.

It is to the credit of projectionists that, for the most part, the audience is unaware of their existence. In the writer's opinion, however, it is *NOT* a credit to the industry to seemingly be unaware of the importance of projection and projectionists. All too often standards are proposed, equipment is purchased and projection decisions are made without consulting the people who must operate and service it.

[There are many facets of this fascinating business of laboratory procedure that should interest all projectionists. IP will endeavor to service promptly all requests for such data.—ED.]

Are You Moving?

If so, please notify us one month in advance. The Post Office does not forward magazines. To avoid delay, please cooperate by sending us both your *new* and *old* address.

FILM TRANSPORT

(*Continued from page 9*)

highly magnified. To avoid unnecessary losses of light and picture quality, do not employ aspect ratios higher than 1/1.85 for non-anamorphic projection. CinemaScope anamorphic prints are best shown at their maximum aspect ratio of 1/2.35.

The Intermittent Sprocket

5. The intermittent sprocket is one of the most finely machined components to be found in a motion-picture projector. Not only must its film-contacting rims be perfectly circular to within 1/10,000 inch, but the sprocket teeth must be spaced with a similar high degree of accuracy. Needless to add, the sprocket must be centered *perfectly* on the starwheel shaft of the geneva movement to avoid 6-cycle "picture dancing."

A good hardened-steel intermittent sprocket should last for several years with ordinary "three shows a day" use before the teeth become notched, hooked, or otherwise so worn that replacement is necessary.

Check for undercut teeth and notches by gently passing the sharp edge of a knife blade from the base of the film-contacting face of a tooth to its tip. A "click" indicates notched teeth which may cause the picture to jump (especially on certain settings of the framing knob) or tear the film perforations.

Projectionists who change their own intermittent sprockets should work the new sprocket onto the shaft very gently with a twisting motion. *Never, never use a hammer!* The shaft may be lubricated with oil to facilitate its entrance into the bore of the sprocket. If taper pins are used to fasten the sprocket, tap them in *very gently* to avoid springing the shaft. A bent starwheel shaft, like a lopsided sprocket, causes the picture to dance up and down six times per second.

Clean your intermittent-sprocket teeth before each show with a toothbrush *lightly* moistened with kerosene. It is best to turn the sprocket over with the handwheel, not the motor, when this is done. (Bear in mind that the manufacturers caution us not to clean or oil a projector when it is running. Serious accidents could happen.)

Intermittent Sprocket Shoe

6. The intermittent-sprocket shoe is intended to hold the film on the intermittent sprocket snugly. If it fails to do this, the film may "ride" the teeth and give a jumpy picture on the screen. Then too, the shoe functions secondarily as a sort of lower lateral guide, hence the need for accurate centering on the face of the sprocket. A laterally displaced shoe may rub against the sides of the sprocket teeth, wearing them down into sharp little chisels which are only too apt to chip fragments from the film perforations.

Test the positioning of your sprocket shoes this way:

Open the film-gate door and switch the projector motor on. Listen carefully to the sound made by the intermittent movement—you can hardly hear it at all! Now, with the projector still running, close the gate door. You will now hear more or less "intermittent noise" (due, at the least, to the friction of the shoe against the face of the sprocket). If, however, the shoe results in *excessive* intermittent noise when it is closed against the sprocket, it is obviously displaced and touching the teeth.

Remove the gate door from the machine and recenter the shoe which is fastened to the gate-door apron. (Certain modern mechanisms may require lateral displacement of the entire door.)

Lint and dust have a strong tendency to collect behind the intermittent shoe and interfere with the action of the tension spring. The time taken to remove such dirt is well spent. Incidentally, the tension of the shoe spring is not critical, but it is a good idea to increase it just a bit beyond what may be needed to insure firm contact of the film with the intermittent sprocket.

They'll Make It, Too

An automatic projection system, called "Euromat," by Siemens & Halske, Germany. Based on the use of a Xenon-light source, the system employs a set of spring switches operating as pulse-generator and an optical cue-scanning system attached to the projector. Sound, including disc reproducer, curtain operation, slide projection and film projection involving, if necessary, films of different widths, can all be automatically preset.

INTERNATIONAL PROJECTIONIST

OCTOBER • 1959

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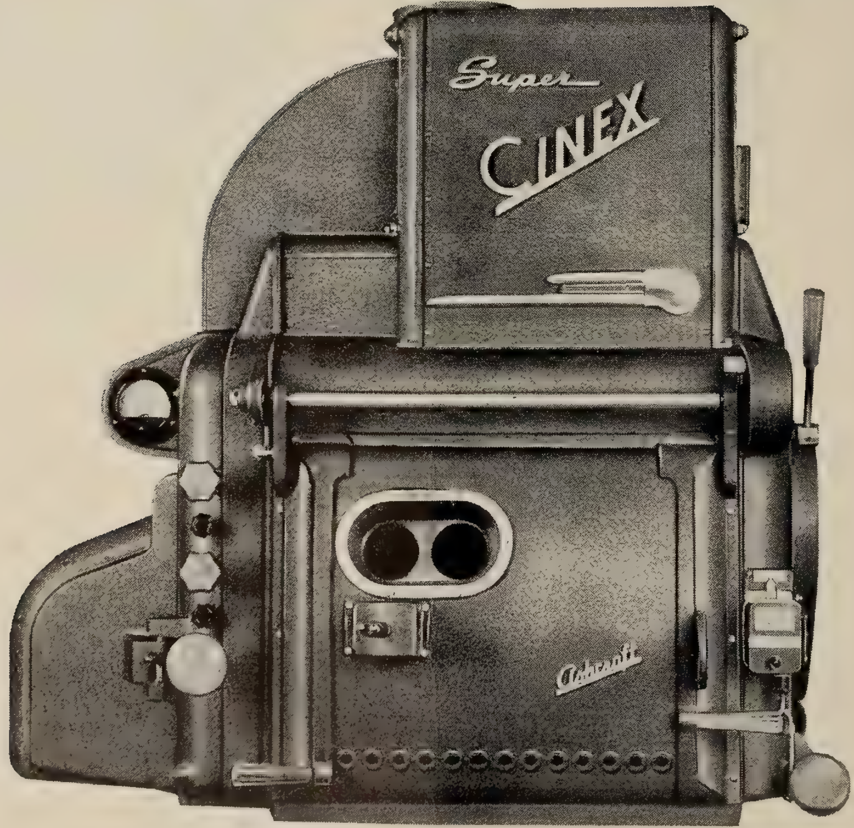

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Monthly Chat

Screen Size — Luminous Intensity

IN OUR last issue (September, page 15) there appeared an excerpt from the Progress Report of the Society of Motion Picture & Television Engineers which gave a bit of additional information relative to the Philips SPP discharge lamp for projection, a unit which IP covered in great detail almost a year ago. This excerpt included a table headed "Maximum Screen Size (Ft.) For Standard Luminous Intensity" at various aspects ratios—1:137, 1:185, and 1:234.

The figures given in this table occasioned comment to the effect that the screen sizes cited were too high, and one reader said they were "impossible of attainment." While the burden for the accuracy of the figures rests on the SMPTE, as clearly indicated in a boldface foreword citing the source of the excerpt, IP offers this simple explanation of the figures being rated as "too high":

Variance in Standards Cited

The German standard on which the table was based is 7.5 foot-lamberts; while American acceptable practice lies in the 12 foot-lamberts range. It follows that to conform to the latter practice the figures would have to be recalculated, which would naturally result in smaller screen sizes.—J. J. F.

The appended commentary by Arthur Mayer, authority on film exhibition, was originally contributed as a guest editorial for the vacationing editor of "The Film Daily." It is presented here not only for its own worth but also because it reflects many of the views expressed in this space from time to time.

The Ostentatious and the Synthetic

MOTORS and movies may not appear to have much in common, yet the decision by the three leading automobile manufacturers to produce smaller and less costly cars has connotations that the picture industry can only disregard at its peril. The Detroit tycoons have recognized more promptly than their Hollywood counterparts that we are entering an era (or perhaps returning to one) where biggest and best are not necessarily synonymous and in which at least a substantial portion of the public is not overly impressed by the ostentatious and synthetic. . . . America's two most spectacularly successful industries of the first half of this century have encountered rough going in recent years.

The Reliance Upon Gadgetry

When business falls off, the two industries react in much the same fashion. They automatically turn first to gadgets like fishtail fins or wide-screen processes, three-tone jobs or three-dimension films. When such novelties quickly exhaust, as inevitably they must, their sales appeal, they both fall back on a common faith in *bigness* as the cure-all—bigness of body and horsepower, bigness of spectacle and stars. This is just dandy for all concerned when it flowers into a Cadillac or "Around the World in 80 Days." It is catastrophic when it results in an Edsel or "The Spirit of St. Louis."

The makers of autos, like those of movies, are honestly convinced that they are giving the public, at least the mass public, what it desires, and that their product reflects rather than molds the taste of the majority. In this respect Hollywood's record is considerably better than Detroit's. We offer our patrons a wide choice ranging from the magnificent to

(Continued on page 21)

This has been going on since 1917!

Yes sir, National Carbon Company has provided free screen lighting technical assistance to the industry since 1917. Today, 12 sales engineers—equipped with compact service kits containing the most modern tools in the trade—are ready to assist on any screen lighting problem you might encounter.

Use "National" projector carbons and call on NATIONAL CARBON for free technical service. It's a tough combination to beat—the best in product . . . the best in service. You'll realize the ultimate in picture quality at the lowest overall cost.

Each salesman's kit contains the following modern equipment: brightness meter, voltohmmeter, clamp-on ammeter, dummy lens, set of alignment rods and accessories, pin-hole apertures, split-plate aperture plates, stop watch, micrometer, ruler and slide rule.

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INTERNATIONAL PROJECTIONIST

Volume 34 OCTOBER 1959 Number 10

Optical Soundhead Maintenance

By ROBERT A. MITCHELL

Those simple things that should be done to insure optimum performance but which, if neglected, spell the difference between a good and a bad show.

SOUND motion pictures became a practical reality with the invention of the photoelectric cell. It is true that many of the early "talkies" employed synchronized disc records, but sound-on-disc, known as the Vitaphone system, was unsatisfactory in practice because of disc breakage and the vexing problem of maintaining synchronization when repairing prints.

Sound-on-film, variously known as Movietone, Photophone, Klangfilm, Phonofilm, *etc.*, required nothing in addition to the familiar 35-mm standard film for the transmission of the sound. The sound was *photographed* on the film in a track 1/10 inch in width and placed just inside the perforations along one margin of the film. Sound-on-film practically eliminated the synchronization problem. The soundtrack is as much a part of the film as the picture itself.

It was decided in the late 1920's to record the sound 20 frames (15 inches) ahead of the picture, a standard which still prevails in 35-mm optical-sound practice. In other words, the film should be threaded so that there are exactly 20 frames of film betwen the projector aperture and the scanning beam in the soundhead. If an error exceeding 2 or 3 frames of film is made in threading a projector, the sound will be sufficiently "out of sync" to destroy the illusion of words being spoken by the actors depicted on the screen.

Threading Procedure Very Important

Most professional projectors are designed in such a way that it is almost impossible to thread up the film very far out of sync. Nearly all 16-mm sound projectors, on the other hand, require greater attention to the *proper* size of lower film loop—that just below the film gate.

Because most 16-mm machines employ claw movements, intermittent film pull-down strokes are occasionally missed when the prints are damaged. When this happens, the lower loop becomes too small, and words are heard a fraction of a second before the actors' lips move—a disconcerting effect (often seen on television) which destroys all illusion of naturalness.

The sound is recorded 26 frames (7.8 inches) ahead of the picture on 16-mm film.

The principle of optical-track reproduction is the same for both variable-density and variable-area soundtracks: the density or area variations photographed in the track *modulate* the thin scanning beam so that the light falling upon the sensitive cathode of the photoelectric cell fluctuates in exact correspondence with the pressure waves of the original sound energy. The photocell functions as a resistor the electrical impedance of which varies in inverse proportion to the intensity of light falling upon it: the more light the less the resistance and the more current that is allowed to flow from the "polarizing" source.

The current flowing through the cell is the "sound current" which is amplified to operate the speakers. It, too, fluctuates in the manner of the sound waves originally recorded.

It may be appreciated that a soundhead can work properly only under certain conditions. First, the scanning beam must be correctly-dimensioned and sharply focused. Second, the soundtrack must be centered in relation to the scanning beam. Third, the film must travel past it with a constant smooth motion at the standard rate of speed (90 feet per minute for 35-mm, and 36 feet per minute for 16-mm, film).

Dimensional Standards Are Cited

The scanning beam for reproducing 35-mm tracks is 0.084-inch long and only 0.001-inch (or, in modern American soundheads, 0.00125-inch) in thickness. Such a beam is thin enough to reproduce all recorded sound frequencies up to 10,000 cycles, and thick enough to pro-

vide a good output with a minimum of film-grain noise.

The most urgent problem confronting the designer of a soundhead is the attainment of absolutely smooth and flutter-free transport of the film past the scanning point. The first soundheads depended upon flywheel-damped "sound sprockets" which pulled the film through sound gates having pressure pads much like those in the gate of a projector mechanism. But direct film drive by means of a sprocket (even though a heavy flywheel is attached to the sprocket shaft) has five serious disadvantages:

(1) "Gear flutter" is imparted to the sprocket by the driving gears and the projector motor unless the flywheel be inordinately large and heavy.

(2) Slower oscillations, resulting in "wow-wows", are created by the flywheel, itself, the exact frequency of the flutter depending upon the mass (weight) of the flywheel.

(3) Very slight departures of the sound sprocket from perfect concentricity with the axis of the shaft to which it is fastened produce "gargle," a more rapid flutter than the wows.

(4) The minute "yanks" imparted to the film by the engagement and disengagement of the sprocket teeth (especially if these be worn) create the high-frequency type of flutter known as "whiskers." Whiskers do not affect the lower tones, but make all high notes (violins, soprano voices, etc.) unpleasantly raspy.

(5) The length of film between the sound sprocket and the point of scanning allows varying amounts of film shrinkage to produce irregular flutter.

None of these disadvantages mar the performance of the more modern type of soundhead employing a specially-damped "sound-takeoff drum" which is driven, not by the gear system of the projector but by the film itself. The "sound sprocket" of this type of soundhead serves only to keep the film moving without regard to its motion past the scanning beam. Because of this, the sound drum and sprocket are rather far apart.

The length of film between the drum and the sprocket is never taut, once the sound-drum has been brought up to speed, but forms a *springy* loop which effectively isolates the film on the drum from possible flutter of the film on the sprocket.

Sound-Drum Tension

The film is held in place on the sound-drum by a pressure-roller assembly which serves secondarily as a lateral-guiding device to keep the soundtrack centered in the scanning beam. The guide-roller assembly must be kept clean and properly adjusted at all times, because too little tension will delay the acceleration of the sound-drum, causing fluttery sound for several seconds after the changeover; too much tension will tighten the springy film loop and nullify the damping arrangement which controls the rotation of the drum.

The sound-drum and shaft are made from one-piece, chrome-nickel steel forging, and are heat-treated to assume the needed rigidity. The sound-drum can never become lopsided in relation to its shaft. To permit the scanning beam to pass through the soundtrack in that portion of the film which contacts the drum, the width of the drum is less than that of the film. The soundtrack and outer perforation margin therefore overhang the edge of the drum.

The Rotary Stabilizer

Now, the remarkable feature of this type of soundhead is the ingenious flywheel, called a *rotary stabilizer*, which is attached to the opposite end of the sound-drum shaft. An ordinary solid flywheel would "hunt" (or oscillate) with the springy film loop in much the same way that a weight suspended from a coil-spring oscillates under the slightest disturbance.

The rotary-stabilizer type of flywheel behaves differently. It *absorbs* all disturbing forces and dissipates their energy without affecting the smooth rotation of the sound-drum. Even the passage of a splice over the drum or the sprocket fails to cause the slightest flutter in the motion of the film.

Rotary Stabilizer Function

A rotary-stabilizer consists of a lightweight metal case containing a free-floating, heavy flywheel which does not contact the circular can-like case except through a film of the viscous oil with which the assembly is filled. The sound-drum shaft is attached to the hollow case; the heavy flywheel is attached to nothing but is pivoted so that it is free to revolve as impelled by the revolving outer case *through the oil-film*.

Practically all of the high-quality soundheads manufactured at present utilize the rotary stabilizer. The direct-sprocket drive of the film through a stationary film gate has been completely abandoned, although many such soundheads, relics of early "talkie" days and "universal bases," still are giving service—better service, even, than might be predicted from a consideration of basic principles alone.

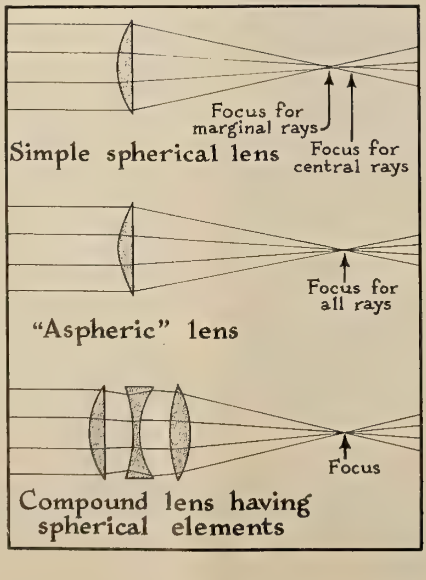
Most Dirt From Film

Satisfactory soundhead operation demands cleanliness of all parts, and particularly of the exciter lamp, photocell, photocell lens, optical-tube lenses, and sound drum (or sound gate in old-style soundheads). Much of the trouble-causing dirt that collects in soundheads comes from the film, which is notoriously prone to pick up dust and dirt by electrostatic attraction.

A wad of film dirt adhering to the sound-drum will cause sound flutter and may project far enough over the edge of the drum to interrupt the scanning beam at each revolution. The result is a periodic thumping noise from the speakers. Although this is more likely to happen in 16-mm than in 35-mm machines, the projectionist should nevertheless lightly wipe the sound-drum with a clean, soft cotton cloth after each reel.

Stubborn deposits of emulsion may be removed from the polished surface

"Spherical aberration" is one of the defects of simple lenses having spherical surfaces. This produces unsharp images because the focal length of the outer zones of such a lens is shorter than the focal length of the central zones.



of the drum by means of carbon tetrachloride.

Never risk marring the drum by scraping it with a metal instrument!

In point of fact, the sound-drums of 16-mm projectors are the most likely to become soiled by emulsion and film wax. Only the clear base side of the film normally contacts the surface of the sound-drum in 35-mm projection.

Cleanliness of Optical Surfaces

A small piece of lint or hair caught in the sound aperture of certain old-style sound gates may cause rumbling noises. If a piece of dirt large enough to block-off one side of the scanning beam lodges in the sound gate, variable-density tracks will play with decreased sound volume; while the output from variable-area tracks will be both attenuated and distorted.

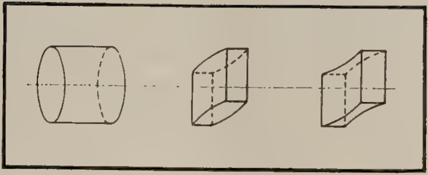
The exposed lens surfaces of the optical tube require daily cleaning with lens tissue, or with a soft cotton cloth moistened with soapy water if they be oily. Dirt and oil-fog on the sound lenses blur the image of the scanning slit and attenuate the higher frequencies of sound. Unfortunately, the optical tube cannot be removed from the soundhead for routine cleaning, inasmuch as its focus position is extremely critical. Wrap two or three thicknesses of cotton cloth or lens tissue around the end of a toothpick to remove dirt from the lens surface directly facing the film.

The sounhead optical tube, like the film-transport mechanism, has been improved over the years. The incandescent filament of the exciter lamp was focused directly upon the slit by a small condensing lens in an early type of optical tube. A reduced image of the slit thus illuminated was focused upon the soundtrack by a small achromatic objective lens.

Although very efficient lightwise, this type of optical tube has a serious defect. The coils of the exciter filament, being focused upon the slit, resulted in a scanning beam having variations in brightness along its length of 0.084 inch! An unevenly-illuminated slit does not affect reproduction from variable-density tracks, but it produces optical cross-modulation and raspy sound from variable-area tracks.

Anatomy of Optical Alignment

A more modern variety of optical tube—the kind used in most 35-mm soundheads today—places the slit very close to the condensing lens. The condenser focuses the exciter filament not upon the slit but upon the objective lens. Because the condenser is uniformly illuminated, the slit is also evenly illuminated. Variable-area tracks play very satisfactorily with this "stereopticon" type of optical tube.



A cylindrical-lens anamorphic attachment functions like a Galilean opera glass having a magnification factor of 2X in the horizontal dimension and of 1X in the vertical.

The Devry 35-mm projector and most 16-mm machines employ the remarkably efficient cylindrical-lens optical system to form an intensely bright, uniformly-illuminated scanning beam on the soundtrack. An exciter having a thin filament is used. Cylindrical lenses form a reduced, "smoothed out" image of the glowing filament directly upon the soundtrack. There is no mechanical slit.

Even though just a bit too sensitive to vibration, and likely to introduce "machine noise" into the reproduced sound, cylindrical-lens optics are quite satisfactory on account of their high optical efficiency, simplicity, compactness, and toleration of small focusing errors.

The usual "stereopticon" type of 35-mm optical tube is easy to focus even though the focus be so critical that great care must be exercised in establishing it. If a 7000- or 9000-cycle test loop is available, the tube is moved into approximate focus and rotated until an output meter connected to the preamplifier indicates a maximum reading. The "azimuth" adjustment is then locked in place, because the scanning beam is then oriented at a right-angle to the direction of film motion. The azimuth should not be disturbed during the subsequent adjustments.

Test Procedure Outlined

The next step involves moving the tube very slowly toward and away from the film (which must be running) until the needle of the output meter indicates a new, and greater, maximum output. The tube is in focus when the highest reading is obtained.

The writer prefers the use of a 9000-cycle test film because the focus becomes less certain at lower frequencies. A test track containing 1000- or 2000-cycle sound is next to useless for optical-tube focusing.

If no test film or output meter is available, a good sound focus may be established by an optical method. A short length of film having a variable-density track of high-frequency sound (many fine striations close together) is threaded into the soundhead. The photocell is removed and a white card to serve as a viewing screen is placed near the normal location of the photocell cathode. When the exciter is turned on, a spot of light will be seen on the card.

The film is then moved down *with extreme slowness* by means of the projector handwheel, and the shadows produced by the soundtrack striations are observed on the card. If the shadows appear as fuzzy bands which *move upward* while the film is inched downward through the scanning beam, the optical tube is *too close* to the film and must be moved away toward the exciter.

If the shadow-bands move *downward* with the film, the tube is *too far away* and should be moved toward the film. The optimum focal position is the one where the finest sound striations cause the spot of light on the card to flicker uniformly without *moving* shadow-bands.

Regardless of the method used to focus an optical tube, the procedure should be followed by a re-centering of the exciter lamp for maximum photocell illumination. With the white card still in place over the photocell socket, adjust the exciter both vertically and sidewise until the spot of light is largest and brightest.

Lateral Scanning Adjustment

The lateral scanning adjustment is made not by moving the scanning beam, but by moving the film, itself, sidewise by means of the lateral-guide roller. This unit is very similar to the flanged-guide roller of the projector mechanism in old-style soundheads, and is located at the top of the sound-gate. In modern soundheads the pressure-roller assembly which holds the film on the sound-drum is fitted with a lateral film-guiding adjustment.

Accurate adjustment of the lateral guide requires the use of a special test film having a black unmodulated track

(*Continued on page* 22)

Looking Backward

By KARL A. BARLEBEN

WE all think only of looking forward, but as we grow older we sometimes enjoy going back in time and reliving bygone days. I now find myself remembering things and places I had not thought about for many years. They are enjoyable memories and, strangely enough, the details come into sharper focus each time I turn to them.

Since these mental wanderings concern projection and a time which I now regard as perhaps the most enjoyable years of my life, it occurred to me that perhaps some readers might be interested in my memories and, so doing, stimulate memories for them.

Coming from a musical family (my father was a member of and soloist with the Boston Symphony Orchestra) I am unable to account for my early attachment for movies. I remember, however, as my initiation in theatrical projection, a visit to a motion picture theatre booth when I was about six years old. My mother took me to see an old school friend who was the "operator" at the Scenic Temple, a converted church which then served as a movie theatre. My parents were married in that church.

A Romance is Launched

I vividly remember the thrill I got upon seeing the brace of Powers 5's being hand-cranked. This was around 1909 or 1910. Eddy Hoyt was the "operator." The rustle of the film through the gate, the odor of warm film mixed with carbon dust, and the brilliant shaft of light focused upon the aperture captured me completely. That was the beginning of a love for projection which I never quite got over.

From this point on I put on little shows at home with a lantern slide projector and later with a toy movie projector which my parents just had to get me for Christmas. I began reading everything I could on the then new movies, and I was a regular attendant at the local movie houses.

I gradually learned all I could about photography and projection as the years rolled on and, of course, I kept my one and only contact in the projection field, Eddy Hoyt. Through him, I was subsequently enabled to get my first job in movies, working after school as a shipper in an exchange: at that time it was Famous Players on Piedmont Street in Boston. This was around 1917, I remember, because the war was then on.

At Famous Players I learned about film inspection, splicing, storing and shipping. I continued to read and study on my favorite subject. Of course, I was headed to be an "operator" but was then

The author, a contributor to more than a score of ranking technical publications, was chief instructor of cinematography at and later dean of the New York Institute of Photography. In 1931 he was made a Fellow of the Royal Photographic Society of Great Britain. During World War II he applied himself to advanced aerial photographic techniques for the United States Navy. He is not only author of more than a dozen books on photographic processes, but has been the review editor of classical music and literary recordings for outstanding publications. Additionally, he has produced a series of radio programs which have attracted wide interest and acclaim.

unable to realize this ambition because at that time in Massachusetts one had to be 18 years old to obtain even an assistant's license. I was then but 16. So I continued to go to school and work at Famous Players afternoons, Saturdays and sometimes Sundays.

"De Luxe"—Circa 1919

I finally became old enough to get an assistant's license, and again Eddy Hoyt, a little, slender fellow who probably was one of the first movie operators in the Boston area, got me several temporary jobs in booths as an assistant. Later he found me a berth that lasted about three years, at the then Gordon's Central Square Theatre in Cambridge.

Here was a de luxe house, for those days, with the latest equipment and a large all-cement booth that actually was built outside the auditorium up on the roof. It had windows, running water, and an adjacent generator room. Two Powers 6B machines graced this new outfit; but after about a year these were replaced by a pair of Simplex machines

The Pay-Off Point

"The best attraction in any medium (theatre showings or on TV) can be all but ruined by poor projection, inferior color or bad TV reception; but the finest technical achievement can't make good entertainment out of poor material. . . . The relation between star salaries and those of the engineers is certainly more startling in our business than in any other industry I know of. Maybe the moral is that you should all have become actors—but at least engineers last longer." —EDWARD P. CURTIS, vice-president, Eastman Kodak Co., at the opening session of the recent SMPTE Convention.

with high-intensity arcs, something brand-new for those times.

This house was a combination film and vaudeville setup working two shows a day with continuous runs on Saturdays and holidays. A 20-piece orchestra was in the pit, plus a huge organ. As soon as I was 20, I applied and got, after taking a test at the State House, a second-class license which permitted one to operate hand-driven projectors only in the presence of a holder of a "special" license. However, I was still an assistant at Gordon's, and as such it was my job to run the spotlights for the vaudeville acts. Two spots were within the booth, and I became quite proficient.

The house was very fussy about letting light spill down into the orchestra pit and in opening and closing the spot on the act on stage: everything had to be precise, even to picking up the act with the proper-sized spot or flood at the proscenium. This was excellent training for me. I also rewound the reels, inspected the film before each show, threaded the projectors and retrimmed the arc. My several years at Gordon's was undoubtedly my busiest time insofar as learning and gaining experience was concerned.

One Hits the Jackpot

Upon reaching age 21 I immediately took a test for a first-class license which permitted the operation of hand-driven projectors on one's own or having charge of a booth with hand-driven machines only. I still coveted the special license which gave one charge of a booth with motor-driven machines; and I again took a test and finally received what to me was then the prize of them all, a special license which gave me complete authority in a booth, with hand- or motor-driven projectors. In those days projectors were only slowly changing over from hand- to motor-drive, and I had gained experience with both.

Meanwhile I continued to study photography and the movies in particular. I carefully studied the films on the screen for techniques, lighting, story content, direction, photography. All this gave me a great advantage which I would not have had had I by-passed working as a projectionist. During this time I went to school and to college; but my failure to follow the musical profession, like most of my family, was a rude shock to my parents.

I managed to remain in my chosen profession despite this obstacle, plus the fact that I was really on my own. Other than Eddy Hoyt, who helped me get started, I had no one to give me a helping hand in this new field.

I remember, while at Gordon's, run-

(*Continued on page* 20)

The problem of the PAINTED GRASS
How to photograph grass in December so that it had June s tender green. That was the problem. That and—the producer hastily added—how to do it on a limited budget. How this problem was solved is a complete story in itself. Needless to say, it fell within the scope of the Eastman Technical Service for Motion Picture Film, an organization devoted to the service of the industry. Offices at strategic centers. Inquiries invited.
For more information write: Motion Picture Film Department
EASTMAN KODAK COMPANY, Rochester 4, N.Y.
East Coast Division
342 Madison Avenue
New York 17, N. Y.
Midwest Division
130 East Randolph Drive
Chicago 1, Ill.
West Coast Division
6706 Santa Monica Blvd.
Hollywood 38, Calif.

LETTERS TO THE EDITOR

Videotape; Century's 35/70

To the Editor of IP:

Nice going, IP, in recent issues, particularly the series on "Videotape Recording," by those Ampex fellows. You'd be surprised how many projectionists are now very much interested in the tape process.

The article on the Bauer 35/70 projector was fine; but I should like a detailed exposition of the Century 35/70 mechanism, since I have operated Centurys for years.

WILFRED A. HEVEY

Meriden, Connecticut.

ANSWER: It's no news to IP that the individual projectionist is intensely interested in the far-ranging possibilities of tape-recording. The trouble here is that there is no *concerted* craft action. As for the Century projector data, this will be forthcoming as soon as Larry Davee or Frank Cahill remember their respective ages and knuckle down to the job of providing a definitive outline.

Projection Arc Light Outputs

To the Editor of IP:

In connection with Table IV of Part I of my two-part article on arc lamps (IP for June, p. 7) general opinion has the view that my value of 35,500 lumens for 13.6-mm mirror lamps burning 165 amperes is a trifle too high. This value assumes the use of a silvered glass mirror, a standard aperture, an *F*:1.7 coated lens, but no heat filter.

The craft overall feels that while this light output may be obtained with *F*:1.5-*F*:1.6 lenses, the value for *F*:1.7 lenses is closer to 32,000 lumens for this current. The difference between these two values amounts to scarcely 10%, and probably is not detectable by the ordinary observer under average conditions. It may be important, however, to the operators of large drive-in theatres where every lumen counts.

Actually, the light outputs of projection arcs are often at the mercy of variable factors which may cause fluctuations in light intensity even greater than 10%.

A glaring example of the disparity between rated lumens and the light actually obtained occurs during CinemaScope projection. Manufacturers often base their estimates on the increased area of the CinemaScope aperture and ignore the fact that the anamorphic attachment, especially if of the prism type, cuts the total light down by 20% or more. The resulting screen-lumen value is thus about the same as it would be with a standard 0.825" x 0.600" aperture and a lens of similar speed.

ROBERT A. MITCHELL

Theatre Sound Level

To the Editor of IP:

For your August editorial on auditorium volume control you deserve a kick in the pants. No Local should stand for it. Anything connected with projection equipment belongs to us. The stagehands don't stand for such nonsense, not even for us. In the early days of sound I worked on setups like this and they were just fine—only too much fussing with it at one moment—but nobody most of the time.

What does this have to do with me? Plenty, because it affects my bread and butter. Where volume level is difficult to get, there could be an auditorium monitor connected to another monitor or meter in the projection room.

We don't need or want any help from downstairs. As for "Porgy and Bess" being spoiled by excessive sound, we had it here—and boy did we have it! I believe that there is, or was, some auditorium setup in a theatre here, but I'm quite sure nobody downstairs had any control of it.

JAMES MCGURRAN

IA Local 173, Toronto, Canada

EDITOR'S NOTE: After 30 years IP is acutely conscious of craft perogatives. On the other hand, however, the craft should not be made the target for unwarranted criticism by a distribution executive who doesn't know his ear from his elbow about projection.

IP does not seek to transfer any degree of responsibility for the reproduction process from the projectionist, even though in the early days the stagehands sought strenuously to gain this jurisdiction. We're still of the opinion that it is virtually impossible to *adequately* control sound level from the projection room; constant observation in the auditorium is the answer—even though only a buzzer system be employed.

When these picture peddlers rap projectionists, some positive expression should be given to the viewpoint of the craft.

'Selenium Sam' & the Mechau

To the Editor of IP:

It has been too many years since we exchanged greetings. I recall the many interesting talks we had and our joint effort to outwit the sound film reproducer "trust" in the early '30's, even to the point of etching a piece of dark glass to provide a sound slit!

This note concerns the article "Who Remembers When?" on page 20 of IP for September relating to the Mechau optical-continuous projector. I recall buying the projector from a Mr. Lester Isaac. It was lying around in the Capitol Theatre in New York where it was collecting, among other things, dust and rust. Subsequently it was turned over to Dr. D. E. Replogle, research director for the Jenkins Television Corp., Passaic, N. J.

We used this projector for experimental television projection from a 35-mm film. I think the year was 1924; maybe you can refresh my memory.

SAMUEL WEIN

Quincy, Massachusetts

EDITOR'S NOTE: Ah yes, indeed, Sam. Wein was commonly known as "Selenium Sam," which sobriquet he justly earned as one of the pioneers in the light-sensitive cell field. He invented a photo-voltaic cell (element immersed in water); was a whiz with vacuum types, and also constructed selenium (dry) cells which he used to wind and coat himself by hand. Result of the latter activity was a rich deposit of selenium on both hands always, and sometimes on his face.

Wein was a frequent contributor to IP through the years, the material for which was drawn from his library of more than 25,000 cross-indexed references!

The Lester Isaac referred to was, of course, then director of projection for Loew's Theatres; more latterly he has been technical director and general exhibition manager for Cinerama.

Sam did not buy the Mechau projector until after 1926; but even this latter date will amaze many people in terms of the serious efforts being expended in the '20's to develop TV—and projection TV, at that.

The "Victoria X" Cinemeccanica 35/70-mm All-Purpose Projector

WE have examined first-hand the Victoria X 70/35-mm projector. This mechanism, manufactured by Cinemeccanica of Milan, Italy, has had world-wide acceptance for more than 40 years. From the 500-seat theatre to that which accommodates more than 5000 spectators, this equipment has won acceptance. Whether the presentation be in the 35-mm medium or the 70-mm dimension, this projector has proven its worth.

One of the projector's oustanding features is the precision balance in the silent-gear train of the total mechanism, resulting in a minimum of strain on every moving part when in operation. This naturally increases the life-span and efficiency of all moving parts and produces a quiet-running projector.

Although the Victoria X was designed primarily for 70-mm film, Cinemeccanica's proven 35-mm projector features have also been incorporated, resulting in full facilities for the showing of 35-mm film.

Immediate Conversion

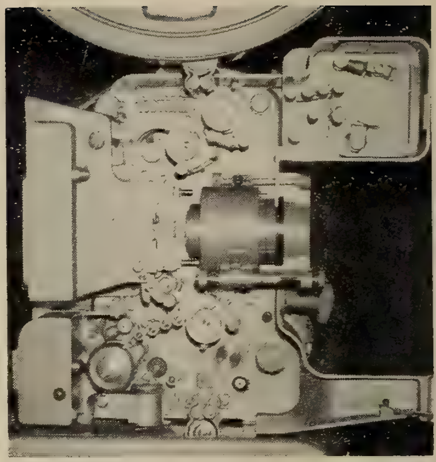
Complete conversion from 35- to 70-mm film, or *vice-versa,* can be made within two minutes, because the gate and runner plate are the only items to be removed and exchanged. The entire procedure has been simplified by *color-coding* all interchangeable parts—red for 35-mm and yellow for 70-mm—a safeguard against any oversight when making the changeover.

The exceptionally large diameter of the dual 70/35-mm feed sprockets permits them to be geared to a lower speed (r.p.m.) thus reducing wear on sprockets, shafts, and bearings. These large-diameter sprockets also provide a greater surface contact or wrap-around for the film, resulting in more constant sprocket tooth engagement. This reduces sprocket-hole wear by distributing the pull over a larger area when running.

The apertures for both 70-mm and 35-mm are of the rapid-insertion-and-removal-type, with positive locking, and they may be removed or replaced while the projector is operating.

The film trap, or gate, is designed with four wide substantial pressure bars which seat on the film within the runner plate film path. The curved gate also incorporates an unusual feature, having a flat film frame at the aperture opening, assuring perfect focus from center to sides. The curved film gate is rigidly held in place by two tapered keeps: it may be removed or installed with ease. *No locking screws are used.* The runner plate is also very easily removed by loosening one small thumbscrew. Jump-and-weave characteristics surpass accepted industry standards.

The five-inch lens mount assembly has been designed to accommodate lenses for both 70-mm and 35-mm with facilities to center the lens (aperture-to-screen) when necessary. The focusing assembly has been designed with a screw-pitch that affords utmost control and ease of focusing.



This photo of the Victoria X threading path may be compared with the diagrammatic line drawings.

The Drive Mechanism

The projection-drive motor is geared directly to the mechanism, with a dual gear-drive providing a change in projector speeds for either 24 or 30 frames per second. The change in speed is accomplished through a substantial clutch assembly mounted on the motor shaft within the projector head. A rotating 90-degree twist of a knurled grip on the motor shaft, with the motor-inching knob effecting the change to whichever speed is desired.

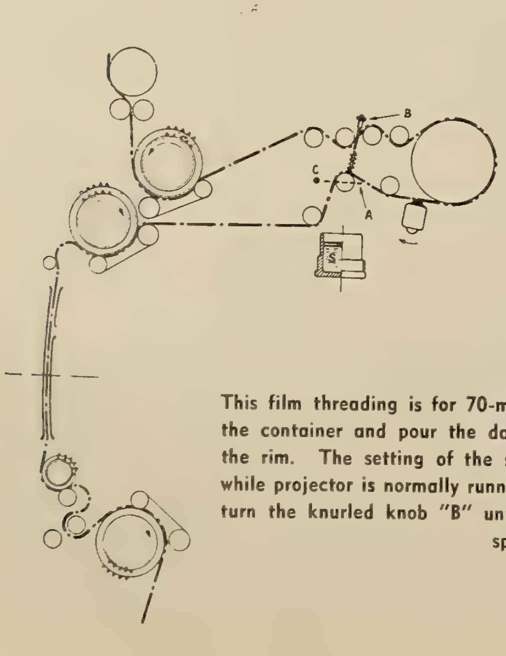
A pressure pump located within the projector provides continual lubrication, constantly feeding oil through a tubular artery system to every moving part. An oil-level indicating glass window, together with an oil-circulating indicating glass window, is on the operating side for the projectionist's observation.

A newly-designed rear-shutter of light weight but sturdy construction is such that light transmission tests show an overall minimum efficiency of 50%. Its drive assembly is spring-loaded, which prevents completely any possible shock or shutter backlash.

The takeup assembly is driven by a separate motor located in the projector base, and drive-disc pressure is effected by the time-proven conventional spring-tension adjustment method. Film tension at starting is maintained by an effective time-delay and relay device.

The heavy-duty enclosed balanced projector base is mounted in a base skirt designed to provide an upward tilt to 10° for drive-in theatres, a downward tilt to 20° for indoor theatre use. Its flexibility accommodates choice of arc lamphouses.

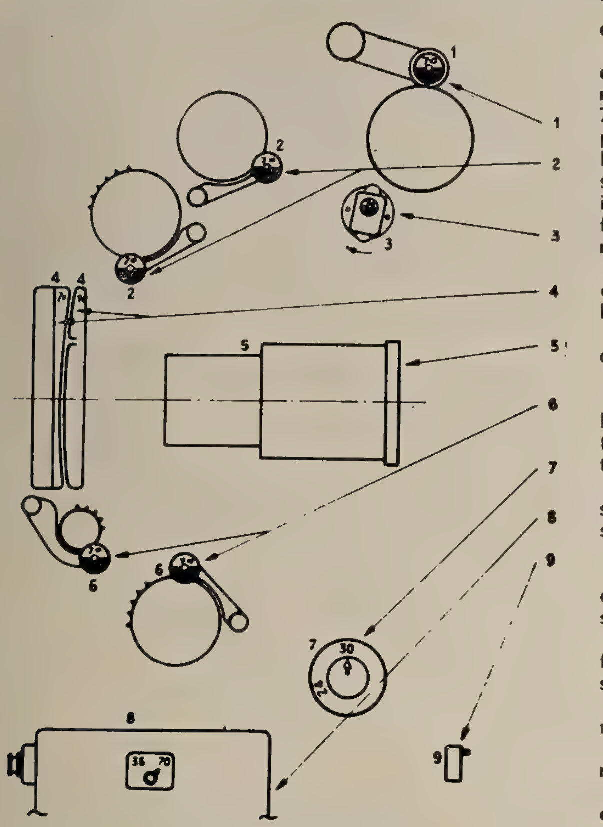
Aperture cooling is effectively maintained by a dual water-and-air cooling



SHOWING METHOD OF FILLING HYDRAULIC DAMPERS ON MAGNETIC SOUNDHEAD

This film threading is for 70-mm reproduction. Directions: Unscrew the container and pour the damping fluid "S" up to ⅜ inch from the rim. The setting of the spring of the dampers is to be done while projector is normally running. On magnetic reproducer damper, turn the knurled knob "B" until the roller axis "A" reach the red spot "C".

INSTRUCTIONS FOR SWITCHING THE VICTORIA X FROM 70- TO 35-MM OPERATION



The only components removed are the gate and runner plate. Others are merely adjusted, and pressure rollers are both marked and colored—yellow for 70—red for 35—to show proper position. Colored knobs are loosened by a few turns of a screw. The procedure in changing from 70- to 35-mm, is as follows (referring to drawing by numbers):

1. Turn pressure roller knob of the magnetic head drum half a turn.
2. Turn pressure roller knob of upper and intermediate sprockets half a turn.
3. Unscrew two knurled knobs of magnetic head, turn the head half a turn, tighten the knobs.
4. Remove 70-mm gate assemblies and insert 35-mm assemblies.
5. Change lenses.
6. Turn pressure roller knobs of intermittent and lower sprockets half a turn.
7. If 70-mm speed was 30 frames per second, set speed shift to 24 frames.
8. Set magnetic preamplifier rotary switch to 35-mm.
9. Insert adapting rings on magazine spindles.

Procedure is similar, of course, for changing back to 70-mm, only in reverse.

system. The water cooling can be taken either from a conventional water recirculator, or from the city line. A specially designed quiet motor-driven blower situated in the projector base circulates filtered air around the aperture and past the film as it passes the aperture. This also serves to keep the aperture and film free from any foreign matter and consistently cool.

Sound Reproduction Setup

The magnetic soundhead, an integral part of the projector, carries a ten-track magnetic cluster, accommodating both 70-mm six-track and 35-mm four-track. Film stabilization is provided by a dual stabilizing system employing both a large drum, flywheel-balanced, and a foolproof dashpot. The optical soundhead, also integral, is designed with a fine stabilizing system consisting of an eddy-current-producing flywheel assembly, plus a similar dashpot filter used in the magnetic soundhead. This combination results in the flutter content being brought well within accepted standards.

A two-stage optical preamplifier with cathode-follower output and volume control which can be fed into the conventional power amplifier, is also built-in to each projector. All projectors are supplied with a D.C. exciter supply and emergency A.C. supply mounted into the projector base.

Both heavy-duty magazines are spacious, with plenty of clearance for the largest reels employed. The lower takeup magazine is an integral part of the enclosed projector base.

The complete projector circuit wiring terminates on strips located in the projector base for easy access. The exciter-lamp switch and control rheostat, together with the manual motor-control switch, framing-light switch, and arc-rectifier switch, are mounted on a control panel on the operating side of the equipment.

Unit Wholly Compatible

All motors are of the three-phase type, offering exceptional stability, coolness of operation and long life. The Victoria X is wholly compatible with Ampex, RCA, Western Electric, and other modern sound systems, as well as with recognized arclamps, such as Ashcraft, Strong, Ernemann, etc. Tension is readily adjustable—10 ounces on the intermittent movement and 12 ounces on the feed sprocket.

Distribution and service of the Victoria X is readily available throughout the world. In the United States, distribution and servicing is confined exclusively to Cinematograph International, Inc., 341 West 44 Street, New York 36, N. Y., headed by George Hornstein.

The distributor promises immediate delivery of the entire installation, prompt setup and efficient service, if necessary.

Questions and Answers On Tape Recording

WHAT seven questions are being asked about the new four-track stereophonic tape? To find out, the Magnetic Recording Industry Assoc. asked dealers across the country to come up with a list of ten favorite questions about four-track, considered now as the biggest development in stereo music. Here are the ten:

Q. What is Four-Track?

A. Whether it be called four-track or quarter-track, it is simply two-track stereo in one direction and two-track in the other—a total of four tracks. During the first run, only the two required tracks are heard; the other two are silent. The direction of the tape is reversed; the two remaining tracks are played; the first two are silent.

Q. Will Four-Track Reels Save Me Money?

A. Yes. Since the process doubles the length of playing time, the cost of the tape itself is cut by one-half.

Q. Do I Have to Rewind the Tape (as With Two-Track)?

A. No. Since the tape is played in both directions, this means no rewind. The tape is wound—and more smoothly—on the *play* takeup reel.

Q. Is the Quality of Four-Track Tape as Good or Better Than Two-Track?

A. Yes. New ultra-narrow gap heads and improved duplicating methods have increased the quality of the new tapes so that they are superior to the old.

Q. Will I Have a Wide Selection of Four-Track Stereo Tapes?

A. Yes, almost 200 tapes this fall with 400 by year's end. One of the most exciting things four-track reel-to-reel is doing for the music lover is to open to him the great music libraries that have been put on master tapes in the past decade by all of the recording companies.

Q. How Many Recording Companies at Present are Producing Four-Track Tapes?

A. Nineteen: Audio Fidelity, Bel Canto, Concertapes, Dot, Everest, Hi-Fi Tapes, Kapp, M-G-M, Mercury, Omegatape, Stereophonic Music Society, Verve, Warner Bros., Westminster, World Pacific, Vanguard, Vox, Elekta, and Roulette.

Q. Do I Need an Entirely New Tape Deck in Order to Play the New Four-Track Cartridge?

A. Yes.

Addendum to Kodak Research Reports

By GLENN E. MATTHEWS
Member, Eastman Kodak Research Laboratories

HOW to boost the rather low natural sensitivity of the silver-halide crystals through the sensitizing processes is reported in another important group of papers. One of the main roots from which much later photographic theory has grown was the discovery that very small amounts of substances in gelatin tended to increase emulsion sensitivity.

A later paper described the isolation of photographically-active sulfur compounds in gelatin, a research achievement said to be comparable technically to the isolation of minute amounts of radioactive material from tons of ore. The identification of these sulfur compounds that form silver sulfide on the surface of the silver-halide crystals had an important part in formulating present theories of photographic sensitivity.

The "color blindness" of silver-halide emulsion grains to anything but blue and violet light led to the development of "sensitizing dyes." A large number of Kodak research papers have recorded the technical results in the synthesis of sensitizers, the theory of how such dyes absorb light, and the general theory of optical-sensitizing and its relation to spectral distribution.

It has been shown that a kind of super-sensitivity comes from certain combinations of the dyes on the surface of the silver-halide grains.

Specialized Chemistry of Development

Chemistry of development was an obviously important subject over the years; and early papers reported on theories of how the developer solution clings to the silver-halide crystal surface and, prompted by bits of the latent image silver, changes the crystals to the silver that makes the developed image.

An unexpected facet of development theory came with the discovery that by usual development the silver-halide crystals turn into a mass of silver filaments. Other papers laid the basis for explanation of the action of different developers and development accelerators.

Wide-Ranging Research in Physics

Much research on solutions for effective processing has led to improved formulas and to prevention of "fog," uneven development, or poor image stability. All such factors were later applied to design of processing-system equipment and continuous processing machines.

The graininess of photographs, which determines how much a negative can be enlarged, was one of the earliest subjects studied among varied research contributions in physics reported in the papers.

The first method for judging graininess depended upon viewing images with the eye; but in recent years this method has been replaced by an ingenious Kodak-developed instrument. The reproduction of fine details in a picture was invaluable when sound motion pictures were introduced, and much of the foundation for the high quality of today's large-screen movies has resulted from knowledge reported in the Kodak papers.

Several papers report the work on the measurement of sharpness of photographic images, called "acutance." These have led to better understanding of the characteristics of photographic images in this important aspect. Many papers on the basic principles of lens design are among the 2000. One describes a completely new system of analyzing the behavior of lenses. Much research on how the eye sees colors has been reported.

A number of the papers have helped the growth of photographic sensitometry —the science of measuring the response of emulsions to light and other forms of radiant energy. It is valuable also in astronomy, spectroscopy, and nuclear physics, where photo materials are often used for the quantitative measurement of infrared, ultraviolet, x-ray, and gamma-ray radiation. Sensitometry has also had wide applications in the control of the manufacture of photographic materials and in control of quality at photofinishing stations, motion picture laboratories, and press and industrial photo labs.

Color Brightens the Photo World

The Kodachrome process was a major landmark in the development of color photographic materials. Later important papers reported on research on color prints and on masking through the use of colored couplers for color-corrected photographs. Papers have also marked arrival of such developments as the first commercially successful monopack negative-positive color system for professional motion picture use.

The fundamental science papers among the 2000 have pointed up many times how the basic research of the Kodak laboratories, directed toward understanding theories behind photographic phenomena, have led to advances in chemistry and physics generally.

Loew's State (N.Y.) 6-Channel Ampex System a Beaut

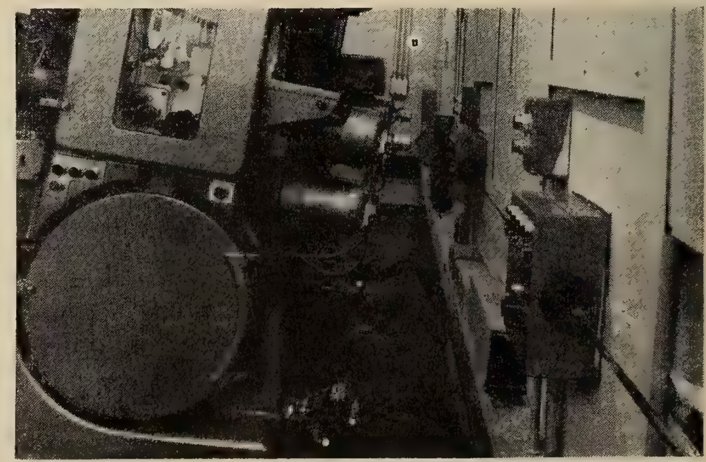
Outstanding in the $1 million remodeling project at Loew's State Theater, 45th and Broadway, New York City, is installation of an Ampex six-channel stereophonic sound system. A total of 840 watts of audio power is provided by the system, one of the biggest ever installed in an indoor theater.

Along with the six-channel system, Ampex also furnished a two-channel stereo tape playback system (Ampex 352) for intermission music.

Sound control units are provided for each projector. The control units are mounted on the front wall of the projection room. By means of the individual controls, one type of sound track can be running on one projector while another type is set up on the second projector.

Sound selection provided by the Am-

Sound control units are mounted on the front wall. Each control unit governs only its respective projector. As a result, one type of sound-track can run on first machine while the other type is set up on the second.



Sound selection provided is Todd-AO Synchronous, Todd-AO Composite, CinemaScope, Optical, or Intermission. A single sound-changeover pushbutton is also included in each station control unit so that sound may be transferred to the adjacent projector. System gain control may be adjusted at any of the station control units. Ashcraft Super Cinex arclamps and Philips 70/35 projectors comprise the projection "team."

This Loew's State installation by Ampex represents one of the largest sound systems ever placed in an indoor theatre. Here are the electronic racks. Included with the 6-channel system (for use with Todd-AO and other filming processes) is an Ampex 352 2-channel stereo tape playback system (visible at far right) which provides stereophonic concerts during intermissions. Each rack swings open from the front, with all components within easy reach for service. Ampex supplies theatres with the only specially-designed, six-channel stereo sound system.

pex-six-channel system includes Todd-AO Synchronous, Todd-AO Composite, CinemaScope, Optical, or Intermission Program. Any one of these types of sound track can be selected by depressing the desired selector switch on the station control unit. One push-button changeover switch provides instant selection for the incoming projector.

Break in Show Remote

With the Ampex system, if any stage speaker power amplifier should fail, it is necessary only to turn the switch for that channel and for channel 7 to the emergency position. This action substitutes power amplifier 7 for that of the offending channel, which is now terminated in a resistive load, and complete stereophonic operation will continue. This does not sacrifice the surround channel, as power amplifier 6 will continue driving those speakers, and the trimmer control for surround speakers will compensate for any drop in surround level.

With the exception of the front wall controls, all equipment in the Ampex system is located in front opening racks, each approximately six feet in height. Wide spacing between the racks, or between the racks and the wall, is unnecessary.

John Kohler, director of sound and projection for Loew's Theatres, Inc., lauded the Ampex installation as meeting every criterion: compactness, easy operation and service, and provision of sound quality limited only by the original recording.

BOOK REVIEW

TV AND FILM PRODUCTION DATA BOOK, *by Ernest M. Pittaro.* Morgan & Morgan, Inc., New York (1959), 448 pages, 132 illustrations, 128 tables. Price: $6.95.

This book is a valuable addition to the literature of TV technology. It should prove useful to all TV production and technical personnel for many reasons. First, it is a concise compendium of detailed information on most of the major materials and equipment units employed in TV broadcasting and film production. Second, it contains a wealth of data on such topics as film emulsions, exposure and shutter times, monochrome and color TV cameras, 16-mm and 35-mm film cameras, videotape apparatus, sound recorders, projectors and multiplexers, lenses, filters, lighting units, animation equipment, film, slide, and opaque formats, etc. An exhaustive collection of useful optical, projection, and general tables is included.

Probably no other single volume of handy size contains such a large amount of reliable practical information for the active TV worker as does the DATA BOOK. But the book is exactly what its title implies, for it is not a *textbook* for the elucidation of principles or for training the uninitiated.

Mr. Pittaro, production supervisor for TV films at Dancer-Fitzgerald-Sample, Inc., provides few—perhaps too few—observations on current practices based upon his long and extensive experience in TV and film production. For example, we find no discussion of the photographic processing of slides and 16-mm films, important technical operations in even the smallest of TV studios. Many readers would like to know more about the printing of 16-mm sound originals in the popular inexpensive printers, the use of drying racks, the avoidance of Newton's rings in both slides and films, the characteristics of color-separation dichroics, the different types of camera tubes, photocells, film waxers and cleaning machines, editing procedures, etc., etc.

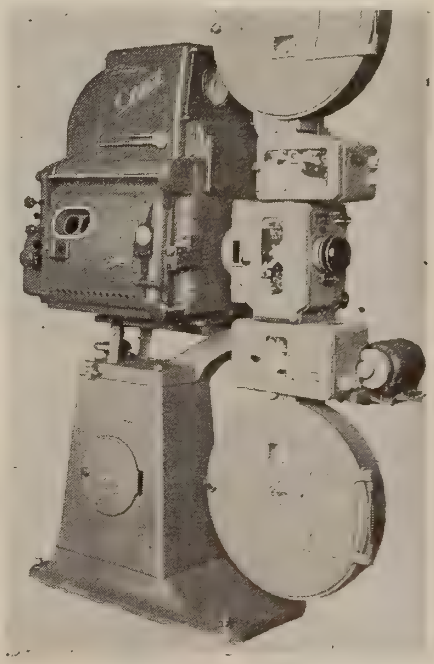
These omissions are nevertheless far outweighed by the wealth of information the book *does* contain. We cannot imagine anyone engaged in TV or TV-film work who can afford to be without a copy. We recommend it highly.

R. A. MITCHELL

Movie Ticket Prices Up

With a single exception, the price of movie theatre tickets has followed an upward course since the close of World War II, advancing from an index figure of 98.4 in 1947 to 135.7 in 1958. In 1950 the figure dropped back, from 102 to 101.6, but there was quick recovery and then sustained advance.

The price of children's tickets increased by 26.5 index points and that of adults by 38.8 points. Prevailing ticket prices in 1947-1949 are used as the index base 100—the variations in later years indicate the going prices or $1 base admission, in those years.



Century Projector Model 35/70-mm with optical and magnetic sound reproducers. Ashcraft Super Cinex lamphouse mounting. Adjustable motor-drive at side (only *one* motor) for either 35- or 70-mm film.

Placement of 16-mm Projectors to Avoid Distortion

To the Editor of IP:

We consider IP eminently qualified to advise how best to place our 16-mm projectors in our new auditorium. How many degrees off a parallel plane may they be placed before distortion of focus sets in?

Audio-Visual Department
Philadelphia Museum of Art

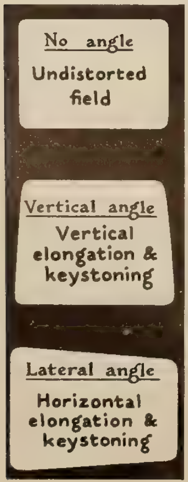
THE problem stated here involves a number of interdependent principles of optical geometry, and cannot be engineered with any degree of precision until such factors as projection "throw," lens focal length, and the contemplated sidewise or vertical projection obliquity are specifically stated.

It is generally conceded, however, that horizontal (lateral or sidewise) projection angle should be kept under 5°, and vertical projection angle under 10°, when the equivalent focus (E.F.) of the projection lens is not less than 4 inches in 35-mm projection, or not less than 2 inches in 16-mm projection. The limiting angles are even smaller with lenses of shorter focal length.

Large sidewise projection angles are especially objectionable because they produce a horizontal "keystone effect" which makes one side of the picture larger than the other.

Prime Distortion Factors

The optical axis of a projector should intersect the center of the screen as nearly perpendicularly as possible to avoid the two geometrical distortions attendant upon excessive projection angles. These are (1) elongation of the vertical dimension of the picture when projection angle is vertical, of the horizontal dimension when projection angle is lateral, and (2) the keystone effect, or trapezoidal field shape, resulting from excessive length of the far side of the projected field. Elongation and keystoning distort all shapes in the picture in all parts of the screen more or less noticeably.



Illustrative of the correct screen image and those factors which are the prime sources of image distortion.

Tilting the screen away from the viewing area so that it faces the projector more squarely is not normally recommended

Even relatively severe projection angles produce no "distortion of focus," inasmuch as the field depths of 16-mm projection lenses are sufficiently great to give a clear picture over the entire area of an obliquely positioned screen. The geometric distortions may nevertheless be intolerable even when the focus is good.

* * *

New Graflex Title Slide

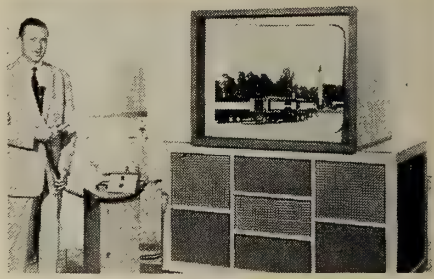
Graflex, Inc., of Rochester, N.Y. has produced a new and unique Title Slide. For those who project 35-mm slides, the new slide solves the problem of projecting a message immediately without the normal delay necessitated by photographing and developing. The slides can be used with any 35-mm projector.

Anyone who can write, draw, trace or print can use these slides to liven their presentation. Errors can be quickly corrected by erasing, and the slides can be used over and over with varying messages. Educators can use them for tachistoscopic training or fast recognition of words and numbers. Price: four slides for 79 cents at any Graflex dealer.

* * *

Multi-Purpose Projector

Staples-Hoppman of Alexandria, Virginia, has developed a new line of multi-purpose rear view projectors the use of which is limited only by the ingenuity and imagination of the person making the presentation. These new projectors, resembling large Tv sets in appearance, combine the features of movie or still projection (slide or strip film), and a microphone. They are self-contained, movable and may be viewed under normal lighting conditions.



Multi-purpose rear view projector.

Of particular interest to the instructor or conference leader is a removable remote panel control (standard equipment) from which the entire presentation may be controlled while allowing him to maintain personal eye-contact with the audience. By merely pressing the buttons on this panel he can show a movie, switch to stills, return to the movie, use the movie sound or replace it with his own narration by using the microphone, without any break in continuity.

These new A-V aids come with either a 25- x 34-inch screen or a 35- x 48-inch screen.

* * *

Protect-a-Print Leader

Protect-a-Print is a new type of film leader. It is currently being used in over 200 film libraries around the country. It is very simple to use—just replace the leader you are presently using. Protect-a-Print removes the hardened emulsion build-up that scratches and damages films. In addition, it helps avoid the misthreading of projectors that is a constant menace to film.

A two-year test revealed a savings of over $16 for every $1 spent on Protect-a-Print. Protect-a-Print will last the life of a print and will not damage the projector. It can be put on old depreciated prints where the value is only $10 and increases the remaining life of the print by 25%—more than twice paying for itself. From Camera Equipment Co., 315 West 43rd St., New York City 36.

* * *

Twin Rear Projection

The Double, Rear-View Projection Screen is a much used aid to the many briefings held each month in the Command Conference Room at Headquarters, 8th Air Force, Westover Air Force

Dual rear-screen projection comparative setup in Air Force Base conference room.

Base, Mass. What appears to be one huge 68 x 155-inch screen is actually two smaller screens, fitted together expertly and covering over two-thirds of one wall in the conference room.

Two Different Slides at Once

Principal use of the set-up is for showing two different 35-mm slide photographs at the same time by using two projectors behind the screen and focusing each on one side of the screen. This offers an excellent method for comparison type instruction on old and new phases of any given subject. By placing the two screens side-by-side, an adaptation for motion picture showings is also possible. The large Plexiglas Lenscreen is installed in the wall of the conference room, with all projection equipment contained in a smaller adjoining room.

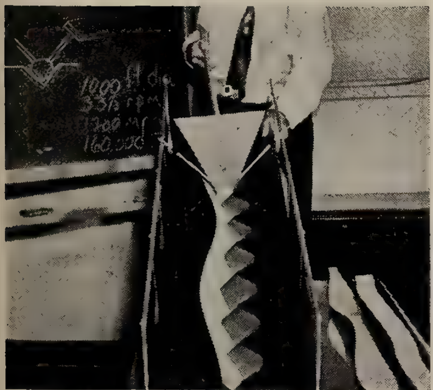
* * *

Still-Animation Technique

Any still picture or drawing can now be converted, easily and inexpensively, into a moving photograph, display, or training device by attaching to the back of the "still" a newly developed transparent material and using a specially screened light source for illumination or projection.

Versatility of Process

The new technique, known as "Technamation" reproduces virtually any type of natural motion, or can be used to create original motion effects, at any speed, in any direction, and in any combination of speeds and directions, in the same picture.



Model of a stereo groove, with a golf ball representing stylus. On stereo records, each groove has two sound tracks; sound is picked up by two arms, one on each side of the stylus.

Broad Scale of Usage

In addition to its simplicity and low cost, the new technique can be applied selectively to highlight the motion of specific parts of an otherwise still subject. This makes it particularly useful to teaching and training applications. In addition to reproducing the motions of solids or liquids, it also can simulate the invisible motion of gases and electric currents.

"Technamation" also can achieve such effects as the moving of blood or drugs through the human body or the action of gases, pistons or gears in a cutaway section of an engine.

This process has been tested and highly recommended by leading educators.

By Technical Animation, Inc., 273 Main St., Port Washington, N. Y.

* * *

Simple as This

Reprints of a published editorial article that explains, in easy steps, how to synchronize sound to a movie are available. The reprints, completely illustrated with photographs of actual editing and synchronizing processes, are distributed free of charge by McMurry Audio-Electronics, Inc., Box 179, Culver City, Calif.

Proper Lens-Cleaning Procedure

Service Bureau, **KOLLMORGEN OPTICAL COMPANY**

CERTAIN misconceptions anent the care of projection lenses have lately been given wide circulation in the non-technical industry trade press, thus this reiteration of proper practice, based on long experience, should be given circulation.

Never under *any circumstances* should water or soap or any detergent be used to clean a projection lens!

Powders Not Approved

Kollmorgen instructions for the cleaning of lenses have been followed for many years, and we have had no negative comments. We get lenses in for reconditioning which evidence that powders have been used in the cleaning process, with the result that the lens coating, especially on the outside of the rear element, has practically been removed.

Solvents and Cloths

We feel that solvents are more advantageous as a cleaning agent than water, soap and water, or detergents and water, because they dissolve oily residue more readily. Also, solvents evaporate, while water must be dried off. We specify lens tissue because it was found impossible to accurately describe just what constituted "clean cotton cloth" or "well-washed" linen. These terms are very misleading and induce much trouble.

Another problem in recommending soap as a cleaning agent was to specify *exactly* what is meant by a "weak-soap solution." In "hard-water" areas considerably more soap would have to be used than in "soft-water" areas. The soap must be removed with distilled water, or layers will form and become baked by the heat of the arclamp. The only possible way to remove such a deposit would be by volatile solvents.

In repair work, we have found that the rear gasket seldom shows any disintegration, regardless of what method of cleaning was employed.

No matter what the method of cleaning, the lens coating, especially on the rear element, will eventually wear off. Kollmorgen has a standard reconditioning job consisting of repolishing and recoating this element, cleaning, adjustment and resealing. Such a job, if it be done every two or three years will, we believe, maintain the lenses in excellent condition.

OBITUARIES

WILLIAM A. LEUTZ, a member of Toledo, Ohio, Local 228 for 45 years, passed away on September 8. He was 61 years of age. He was employed at the Rivoli Theatre for the past 30 years, at which time RKO took over the house. He served Local 228 as treasurer for more than 20 years.

• • •

ROY O'CONNOR, who held membership in Toronto, Canada, Local 173 for the past 18 years, died on July 26. He had a long and varied career in the film industry, including membership in Cameramen's Local 644, Toronto, chief cameraman for the Ontario Provincial Government, and manager of the Prince of Wales and Eastwood Theatres. Earlier he travelled extensively as a film salesman for Pathe; but in later years he owned and operated MovieCraft, which company made trailers for the trade.

• • •

HARRY GILLETLY, for 25 years a member of Cleveland Local 160, died on August 15 after an illness of several months. He came to Cleveland from Akron, where he was business manager of the Local. Two years ago he retired after manning the projection room in the Park Theatre for many years. Surviving are his wife, two daughters and two sons.

• • •

BENJAMIN ROTKER, member of Local 306, N. Y. City for the past 36 years and projectionist at Radio City Music Hall for nine years, died on August 7. He had extensive show business experience, including the roadshow "Don Juan" with Vitaphone; with Western Electric (later ERPI) making installations throughout the U. S. and breaking-in projectionists on the equipment; a roadshow for Orson Welles called "Around the World in 80 Days"; "As the Girls Go" for Mike Todd, and at Republic Pictures home office.

He was a member of numerous fraternal and philanthropic organizations, including a Masonic Lodge and the 25-30 Club of N. Y.

In addition to his wife Anna and a daughter Joan, he is survived by two sisters and four brothers, all of the latter having been or now are projectionists: Morris J., retired, now a Court attache; Harry, at Radio City Music Hall; Alex, at Riverside Theatre, and Louis at the New Amsterdam Theatre, all members of N. Y. City Local 306.

• • •

WILLIAM H. BASSETT, who worked for local theatres in Tulsa, Okla., for more than 30 years, has passed away. His Local was 513. He was active in the American Legion and in the Masonic Order. Surviving are his wife and a son.

• • •

GEORGE H. WALTER, assistant to the president of Lorraine Carbons, Inc., at Boonton, New Jersey died suddenly recently. His age was 53. Walter was Lorraine's field man and as such had intimate contact with thousands of projectionists.

• • •

JOHN H. KLIEGL who in 1911 invented the famous light which bears his name is dead at the age of 89. For many years the film studios were dependent mainly upon this light source.

Short-Focus Lens Adapter

A short-focus adapter described as a "new radical concept" for 35/70-mm projection has been announced by Vicom. It was designed primarily to function jointly with present available high-quality prime lenses in focal lengths from 3½ to 6 inches. It then reduces these focal lengths by one-half and the resulting lens would be from 1¾ to 3 inches.

It is well corrected for aberrations, including distortion, color, and actually improves the existing prime lens. Its size assures maximum light transmission and non-vignetting coverage of all high-speed lenses.

Its glasses are the finest optical types, and the design is entirely new, patent applied for, so as to produce results never before obtained with short-focal length lens systems. Vicom at 70 Aberthaw Road, Rochester 10, N. Y.

W. H. Feathers is New Head of National Carbon Co.

WILLIAM H. FEATHERS has been elected president of National Carbon Co., succeeding Adger S. Johnson, who has been advanced to a vice-president of the parent company, Union Carbide Corp.

Mr. Feathers has been vice-president and general manager in charge of industrial products since 1954. He joined

W. H. Feathers

Union Carbide in 1937, and his experience has been chiefly with National Carbon's production operations both in the United States and abroad. He graduated from Virginia Polytechnic Institute in 1937 and subsequently did graduate work under a Sloan Fellowship at Massachusetts Institute of Technology in 1951.

He will headquarter in New York.

Isaac Leaves Cinerama

Lester B. Isaac, for many years director of projection and sound for Loew's Theatres and for the past six and one-half years director of exhibition for Stanley Warner Cinerama Corp., has left the latter post. This followed the sale of the S-W interest in Cinerama to Cinerama, Inc.

Isaac directed not only all technical phases of Cinerama installations and operations but he also supervised the merchandising aspects of the pictures, the latter resulting in all-time record runs and box-office grosses. He has not announced his plans for the future.

Where to See The Victoria X

Brochures and other printed material serve a useful purpose in describing a unit of equipment, but in the case of a motion picture projector there is no substitute for first-hand inspection of an actual installation where the unit can be seen in actual operation. IP will publish from time to time a list of installations of the new 35/70-mm projectors so that projectionists in the area may view the units in operation.

The Victoria X projector is now installed in the Shore Theatre, Huntington, Long Island, N. Y.; the Center Theatre, St. Petersburg, Florida, and the State Theatre, Wichita Falls, Texas.

This projector, manufactured by Cinemeccania of Milan, Italy, and distributed in America by Cinematograph International of New York, has been used extensively throughout Europe for many years as well as in the Near and Far East.

LOOKING BACKWARD

(*Continued from page* 8)

ning several shorts made locally, a rarity for Boston then, photographed by a C. P. Robb. One I remember was an aerial trip along the Massachusetts seacoast showing the famous areas. In those days this was quite an achievement, and I developed a fond regard for this C. P. Robb, one of the pioneers. I never dreamed I should ever meet him, but chance had it that several years later I worked with him along the North Shore in making films of the millionaire colony, including the famous visit of the then Prince of Wales. Robb used an Akeley camera, one of the first to be seen in Boston, and it was with this rig that he had shot those first films I used to run at Gordon's. Strange how fate operates!

Gradually I crept into photography and owned several cameras, 35-mm of course, because 16-mm film had not yet been thought of. It was not too long, however, before Eastman put out 16-mm film, and both Robb and I went into this new field as a supplement to standard theatrical material. I also made some newsreel material on my own and tried to peddle it to local movie houses — usually getting the worst end of the deal. I was not smart enough then to first get an order to do the job, but went ahead shooting the stuff with the expectation of selling *after* it was made.

For two summer seasons I was the projectionist in a little theatre at Houghs Neck. I had two broken-down Powers 6A's, hand-driven. Then I held another spot in Atlantic, not far away, with Powers 6B motor-drives. These theatres were open only two or three days and nights a week, so I had plenty of time to devote to my other interests. Another booth I was very proud of was the one in the Needham Theatre. Here I had a brace of Motiograph De Luxe machines. I handled this job for about a month or so as a substitute. Later I spent a few months at the Lawler Theatre in Greenfield, Mass., where again I had Motiograph De Luxes.

The Cameraman Emerges

Here again fate played a strange trick on me. After my stint in Greenfield, a lovely little town located at the western end of Massachusetts, I turned more and more to the photography end of motion pictures. One of the various assignments I took was as cameraman for a company that toured New England ballrooms making "Contest Movie Balls" at which the first night consisted of shooting several hundred feet of film of the dancers and staging a beauty contest and screen test. The following week the film would be shown in the ballroom and the contest winner selected; and the third week the prizes, collected from the local stores in exchange for newspaper advertising and publicity, were turned over to the winner.

It so happened that about a year after leaving Greenfield I found myself there again, this time in the role of cameraman. The newspapers got wind of it, and I was traced as the projectionist at the Lawler Theatre of a year ago. They wrote the whole thing up and actually talked as though I were a native son returned home.

From this point on I found less time to devote to projection, although I retained my Massachusetts license—just in case. I also started to do a little writing in the magazines. This activity resulted in my getting an offer to teach cinematography at the New York Institute of Photography. This brought me to New York, where I have since made my home. From about 1927 on I was engrossed in various other phases of motion pictures and writing, hence lost my former contacts in theatrical projection in New England.

Projection Experience Invaluable

The point of all this memory lies in the fact that I can honestly attribute whatever small success I may have had in the motion picture field, in its many ramifications, most of which I explored and worked in, is due to my being weaned in a projection booth, so to speak.

It was projection that captured my fancy to begin with, and it was projection that enabled me to fully understand and study motion pictures in its other aspects. I often think I should like once again to work in a booth, especially now with sound, the various processes now offered, and the vastly improved projectors. In any case, projection will always have a most active spot in my mind.

[ED's NOTE: The foregoing evokes memories of those stalwarts of the projection craft who, in the 20's, contributed so much to the advancement of the art. Those were the days when Art Smith, projection chief at both the Capitol and Roxy Theatres on Broadway (NYC), was considered by many to be the Pooh Bah of the craft. Now, unfortunately, he is missing from our ranks along with P. A. McGuire ("Better Projection Pays"), and George Edwards, who was the guiding spirit of the American Projection Society. These are the people who, through their perseverance and unrelenting regard for craft standing, contributed in a major sense to the welfare of motion picture projectionists.]

Brochure on 10 Arcs

Projection lamps to meet the needs of all theatres are described and illustrated in new literature now available from National Theatre Supply Co. Ten different types and models of lamps, including the "blown" arc and the new 70-mm lamp, are included in the brochure. A free copy may be obtained at any branch store.

MONTHLY CHAT

(*Continued from page 3*)

the moronic, while automobile models have come to look so much alike that if you leave a Ford and a Chevrolet overnight in the same garage, nine months later you will have a Plymouth.

Size—Sales Relationship

Significantly, the only oasis of expanding prosperity in both industries is in the one area that challenges the assumption that size and sales march hand in hand. The demand for foreign films and foreign cars—less costly, less sumptuous, appealing primarily to people of better than average taste—has risen in recent years by leaps and bounds.

In 1955 less than one per cent of the total automobile market went to European models. This year it will rise to 10 per cent, and if we add to this the sale of small American cars, the total will be close to 17 per cent. Meanwhile, the number of foreign language films imported rose in the last decade from 93 to 585. In 1958 these pictures grosedd close to $15 million. The number of art houses has more than quintupled and, what is even mor striking, thousands of strictly commercial theatres which formerly never even considered playing a foreign film are today showing them on frequent occasions.

Why this has occurred is no more mystery than the average mystery movie. The failure of the automobile manufacturers and the picture makers respectively to make good small cars and good small films has created a vacuum into which the foreign product has forced its way.

As far as pictures are concerned, these foreign films, with the obvious execption of an occasional sex sizzler, are not even particularly well liked by American audiences. They are shown outside of art theatres only because Hollywood has fallen down on its job and is not producing enough pictures to keep our screens occupied.

The "Blockbuster" Obsession

Our picture makers are obsessed by the blockbuster bugaboo. The only alternative they envisage to pictures costing millions, of which obviously only a limited number can be produced annually, are horror and science-fiction quickies which are an insult to the intelligence of even the teenagers who have become the bulk of our theatre audience.

When occassionally a courageous producer dares to challenge this myth, whether with a reasonably expensive "Imitation of Life" or an inexpensive "Capone" or "Shaggy Dog," his profits are proportionately far greater than those of the blockbuster addicts. For

there is today, as there always has been, a middle-class, middle-brow, middle-of-the-road audience neither ultra-intellectual nor ultra-moronic, an audience which does not want to sit through three-hour features or pay $2 admission charges, an audience which wants to get a moving experience when it goes to a moving picture, and gets such an experience from good stories rather than from super colossal sets or superannuated stars.

This is not a "lost audience" but one which we have deliberately driven from our doors. It has been equally neglected by TV. It is only waiting for picture makers to evince a little of the vision and the courage and the faith in the American public that the auto makers are now displaying.

SOUNDHEAD MAINTENANCE

(*Continued from page* 7)

bordered on one side by a series of dashes (the "chopper track") and on the other by a row of dots (the "buzz track"). The guide is adjusted to the point where no sound is heard in the speakers while the test film is running through the head.

The lubrication of a soundhead is confined largely to the drive, or gear, side. Manufacturers' instructions should be followed anent the oiling of the sprocket idlers and lateral-guide rollers. (Some soundheads require no lubrication of any kind!) If oil-holes are provided, frequent *sparing* lubrication will be found more effective, and certainly cleaner, than canfuls of oil splashed all over the parts at rare intervals.

Guard against splattering oil on the lenses of the optical tube, which should be scrupulously clean at all times for crisp, high-fidelity sound.

This same precaution should be extended to the lubrication of old-style projector heads to prevent the leakage of oil into the soundhead.

Tips on Sound Reproduction

Perfect sound is not guaranteed by a soundhead in perfect condition because, of course, there may be something wrong with the amplifiers or speakers. Nevertheless, the sound cannot possibly be satisfactory when the soundheads fail in their function. (Certain old-model soundheads are physically incapable of reproducing acceptable sound.)

Now, because projectors are unavoidably noisy, and projection-room monitor speakers are purposely made to "kill' the lower bass tones which might be heard in the auditorium as an annoying "echo," it is recommended that the projectionist occasionally listen in on his sound either by joining the audience while an assistant runs the show or by using earphones in the projection room.

Simple Testing Procedure

High-impedance headphones (15,000-25,000 ohms) may be connected directly across the power-amplifier output which feeds the stage speakers. This output is generally under 500 ohms impedance. In most cases the sound in the earphones will be too loud, so a ½ or 1-megohm potentiometer connected as a variable resistor *in series with the phones* may be used as a volume control. Such a potentiometer may be purchased at any radio shop.

To use a potentiometer as a resistor, cut it into one of the two wires from the headset, using the center terminal and only one of the outside terminals, ignoring the other outside terminal. Earphones provide the best means of checking sound quality at any desired time; and with their aid he can detect slight faults which cannot be heard in the monitor speaker.

New Genarco Arc Spot

JUST ISSUED is a pamphlet, designated No. 289, which describes the latest Genarco high-intensity, carbon arc spotlight designed for large theatres, auditoriums and arenas with a throw of from 125 to 250 feet. The light output is rated at 14,000 lumens.

The arc operates at 60 amperes using 7-mm copper-coated Suprex carbons, with the 12-inch carbon operating for 2 hours, while the 14-inch carbon will operate for 2½ hours. A 16-inch reflector is used. The lamp has free motion in both the vertical and horizontal planes, with a vertical tilt downward of 55° and upward of 30°.

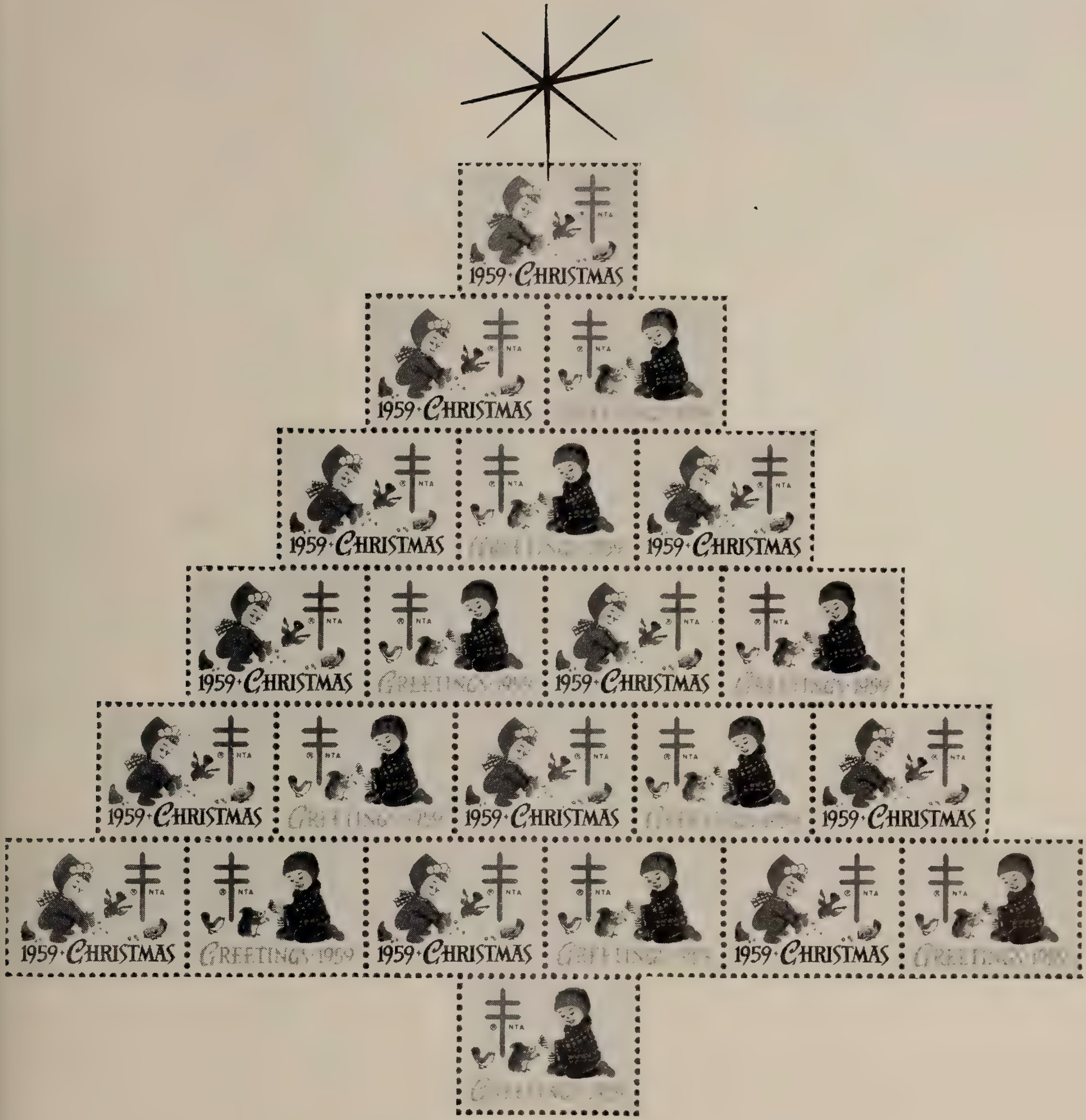
Full particulars are available from Genarco, Inc., 97-04 Sutphin Blvd., Jamaica 35, N.Y. Ask for No. 289.

T.O.A. Chicago Convention

Theatre Owners of America will hold its annual convention which will include a mammoth trade show featuring both equipment and concession exhibits Nov. 8-12 inclusive at the Hotel Sherman, Chicago. Projectionists in the area are urged to attend the trade show.

Are You Moving?

If so, please notify us one month in advance. The Post Office does not forward magazines. To avoid delay, please cooperate by sending us both your *new* and *old* address.


1959·CHRISTMAS
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Norelco® UNIVERSAL 70/35mm PROJECTOR

the original PHILIPS/TODD-AO®

...known by the company it keeps

Continuous in-service operation is the acid test of the quality and reliability of the NORELCO multi-purpose projector, DP 70. Every one of the nation's seventy-nine theatres — and seventy-five more throughout the world — equipped for Todd-AO and all other 70mm processes, furnishes proof of the NORELCO's efficiency, versatility and outstanding performance.

The NORELCO DP 70 was designed from the ground up, specifically as a 70mm to 35mm universal projector. It is not an adaptation of a 35mm machine and is, therefore, unique among 70mm projectors. Small wonder, then, that long print life is routine with the NORELCO projectors. Runs as high as six hundred per print have been reported from theatres.

In view of the investment involved in equipping your theatre or drive-in for 70mm, you owe it to yourself to demand nothing less than *concrete* evidence of *proven* excellence before you determine *your* choice of a universal projector. And, based on the available evidence—in the projection booths and on the screens of the world's leading theatres—investigate the superior performance and obvious economy of NORELCO projection equipment available now.

Here is your check-list of many outstanding features of the NORELCO DP 70, the original and only time-proven 70/35mm projector:

- *Fully compatible with, and quickly convertible for: 70mm or 65mm film with up to six magnetic sound tracks; 35mm CinemaScope with four magnetic or single optical sound tracks, and Perspecta-Sound, Wide Screen film of any aspect ratio with either magnetic or optical sound and standard 35mm film.*
- *Scientifically compounded curve of light gate—prevents film buckle.*
- *Single blade, double speed conical shutter, providing highest light transmission of any projector. Leading and trailing edges have integral air scoops that aid in dissipating heat.*
- *Rollers, drums, sprockets and film gate made from non-magnetic materials—eliminates possibility of magnetic sound track damage and necessity for frequent degaussing. Dual sprockets on all shafts machined of hardened aluminum alloy. No sprocket change required when changing from 70mm to 35mm or vice versa. (Less than 4 minutes required.)*
- *Two independent motors on each projector, 24 and 30 fps—all past, present or contemplated 70mm films can be projected without additional expense or modification.*
- *Combination ten-track magnetic clusters, no tricky threading required when changing from six- to four-track reproduction.*
- *Triple filtered metered lubrication system.*
- *Substantially constructed for rock steady projection.*
- *All modern, domestic high-power arc lamps adaptable without loss of efficiency.*
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- *Complete stock of replacement parts always available.*
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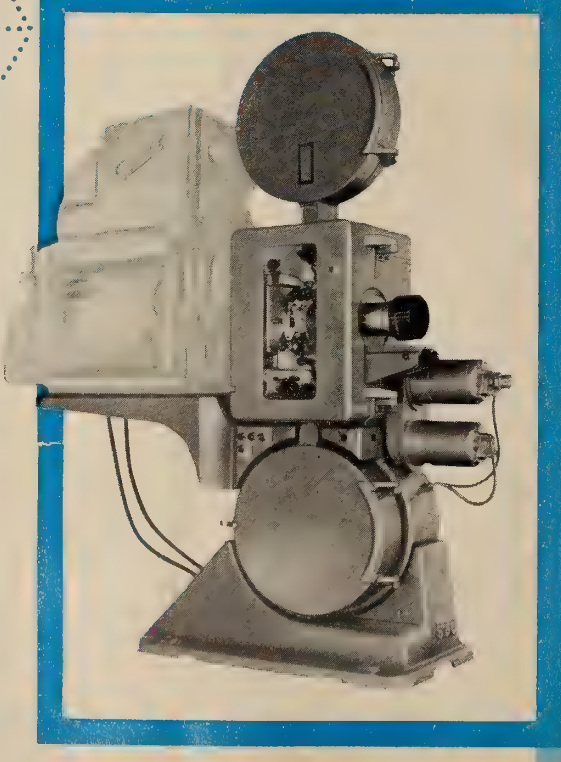

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Vancouver, B. C.	*Stanley Theatre*
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INTERNATIONAL PROJECTIONIST

NOVEMBER • 1959

VOLUME 34 • NUMBER 11

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International PROJECTIONIST

Including a special Audio-Visual section relating to the operation and maintenance of A-V equipment in the educational and industrial fields.

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Monthly Chat

The Halt, The Meek, And The Blind

MANY years ago there was published a novel which traced the life-courses of a group of people indigent to the Lower East Side of New York City which was aptly titled "Haunch, Paunch and Jowl." Prominent among the characters delineated in this book was one who, meek and supplicating in his formative years, went on to garner many dollars and their concomitant power which led him to become blatant vocally and bloated physically.

This tendency is apparent today in many areas, but nowhere is it more pronounced than in the motion picture industry. Those who in the '30's were bleating are now bloated and utterly impervious to those who posted the original signposts along their road to eminence.

We've been itching for weeks to display prominently in these pages certain remarks of an eminent industry personality who, never blatant and certainly not bloated, has always enjoyed the blessing of clear vision and rock-steady footing. We refer to Edward P. Curtis, vice-president of Eastman Kodak Company. Here is an excerpt from his address at the opening session of the recent SMPTE convention:

"Color pictures, stereophonic sound, wide-screen processes are only a few of the many outstanding developments for which our engineers are primarily responsible. And yet I somehow feel that in terms of its application to the entertainment field our achievements have perhaps lacked the imagination that has characterized man's advance in space. We haven't had a breakthrough comparable to a Sputnik or a moon shot that has lifted entertainment to new high levels aside from and since the advent of TV. We have had improvements aplenty but nothing that has really given a startling new look to the art of entertainment.

"In saying this I confess I do not have in mind exactly what our engineers might have accomplished which they haven't done. Perhaps one simple example might be the development of three-dimensional pictures in color—needless to say without the use of glasses—but there are others.

"I might hastily add, however, if we have had any shortcomings in this respect, it is not primarily the fault of the engineers. Nor, I think, is it quite fair to lay it to the fact that your bosses are not as sympathetic to the engineer and his problems as they might be. I have heard this opinion voiced more often in motion picture circles than among TV engineers, but it comes from both and there is some truth in it.

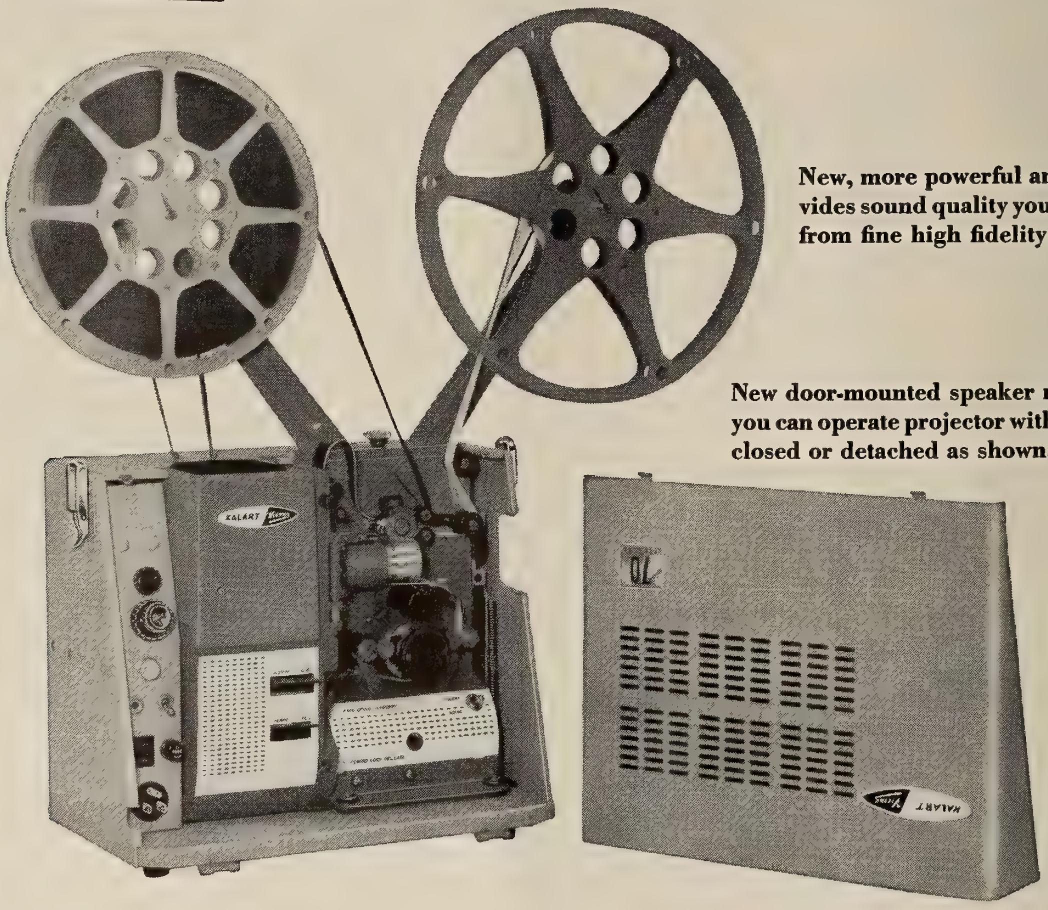
"This is basically because entertainment is not in any sense an exact science and never will be. It will always depend primarily on creative talent, and we cannot blame the responsible producer if he many times seems more preoccupied with story properties and stars than he is with improved sound quality or getting more speed and better definition.

"True, the best attraction in *any* medium can be all but ruined by poor projection, inferior color or bad reception, but the finest technical achievements can't make good entertainment out of poor material. I would not necessarily imply that money is the ultimate criterion in judging performance, but the relation between star salaries and those of the engineers is certainly more startling in our business than any other industry I know of."

Ditto for the exhibitor-projectionist relationship.

NEW KALART VICTOR

16mm SOUND PROJECTORS



New, more powerful amplifier provides sound quality you expect only from fine high fidelity equipment.

New door-mounted speaker means you can operate projector with door closed or detached as shown.

Offers the Basic Improvements You've Wanted for Years

If you have been waiting for basic improvements in 16mm sound projector performance the new KALART/VICTOR will be a delight to your eyes—and ears. Here are just a few of the reasons why:

1. Distracting mechanical noises are completely eliminated. With projector mechanism completely redesigned, KALART/VICTOR is now the quietest running of all leading 16mm sound projectors.

2. Amplifier power is increased for better sound reproduction. A new 15-watt amplifier has been audio-engineered for KALART/VICTOR Model 70-15 projectors. It provides undistorted sound reproduction over a frequency range comparable to that of the finest high fidelity equipment.

3. Speaker placement is more flexible than ever before. In-the-door speaker mounting now means that the speaker operates on the projector itself, next to the projector, or up to 50 feet away.

4. Lubrication is required only once a year. Improved mechanical efficiency and elimination of high-speed components make oiling necessary only at annual servicing.

5. Light output is vastly improved. A more efficient shutter alone provides a 12% increase over previous Victor models. Incorporation of new shuttle framing further boosts light output. The KALART/VICTOR encourages still picture projection, too. Stills are 5 times brighter with no cost increase for optional "extras."

See and hear the new KALART/VICTOR at your authorized Victor Dealer today

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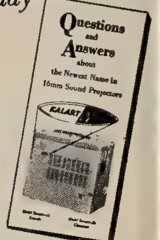

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INTERNATIONAL PROJECTIONIST

Volume 34 NOVEMBER 1959 Number 11

The Causes of Focus Drift

By ROBERT A. MITCHELL

A down-to-earth exposition of the underlying causes of one of the most important projection problems, together with practical suggestions as to how to limit severely its adverse effect upon the screen image.

EVERY PROJECTIONIST has learned by experience that different film subjects—and different types of film—require slightly different lens settings for a consistently sharp focus on the screen. Further, the focus usually "drifts" in a slow, progressive manner during the projection of a single reel of film. That is, the lens setting which suffices at the changeover fails to provide a sharp image toward the middle and, especially, at the end of the reel.

The need for different focal positions of the lens at different times and with different prints, absolutely precludes the feasibility of "focusing scales" or lens markings which can do no more than indicate, in an approximate way, the *average* focus which has been determined by experience over a period of time. But however helpful such lens markings may be in the replacement of lenses which have been removed from the projector (to get them *approximately* in focus), they establish a perfect focal position for any specific print only by chance.

Only One Sure Method

Actually, there is only one method by which a film can be focused on the screen *and kept in focus,* namely, the method of careful visual supervision. The projectionist should establish an optimum focus at the beginning of each reel and check it several times during projection.

Minor focus adjustments are made by slowly turning the lens knob in the required direction and stopping the moment that a clear image is obtained in the central area of the screen. "Overshooting" the focus and racking the lens back and forth should be avoided —the audience should not be made aware of the operation.

If the lens has "flat-field" characteristics, the sides of the picture will be in focus when the center is sharp, but it is always the center, never the sides, which the projectionist "sharpens" when focusing is necessary.

The different focus requirements of different types of film are most readily observed during the projection of reels of trailers made up of short rolls of black-and-white and color film spliced together. Sections cut from large reels require a different average focus than do small, tightly wound rolls even though the type of film is the same. It also makes a difference whether the film is old or new and whether it has previously been stored wound with the emulsion side out or in.

Lens Depth of Focus

Projectionists working in theatres where long-focus lenses are used for long projection throws are least bothered by focus drift and other changing focus requirements of film. The reason, of course, is the larger depth of focus of the long-focus lenses. Conversely, the short-focus lenses used in the average theatre for non-anamorphic wide-screen projection show up focus drift, film buckling, and other focal changes rather conspicuously, and thereby demand constant vigilance on the part of the projection crew. The use of binoculars or small "screenscope" telescopes for checking and adjusting the focus of the projected pictures are highly recommended for all theatres.

It sometimes happens that the picture *on the film* is slightly out of focus. This may be a deliberate effect, as in "soft-focus" scenes, or inferior anamorphic lenses may have been used in CinemaScope photography. There is nothing that the projectionist can do to sharpen an image which is unsharp on the film. The practice of focusing the scratches which may be present in

the print is condemned because the scratches may be on the base side of the film. When these are brought into sharp focus, the emulsion side is necessarily out of focus.

Now, the progressive drifting of the focus during the showing of a reel of film has long been the subject of controversy. All projectionists are well acquainted with this annoying effect and seek to understand its causes in order to combat it more effectively.

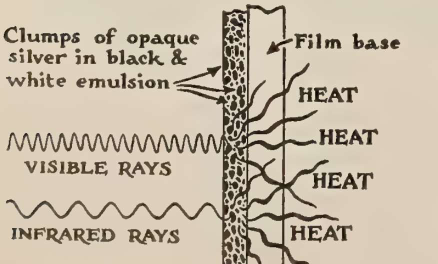
Some authorities blame the effect of heat on the projection lens, others the varying amount of curl in the film itself because the inner convolutions of a roll have a greater curliness than the outer convolutions of greater diameter.

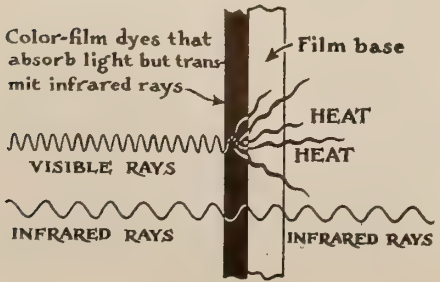
Lens Expansion Discounted

It may come as a surprise to many that there is no experimental evidence whatever that the expansion of a projection lens under the normal projection conditions of high heat is responsible for focus drift. If the heating of a lens altered its focal length sufficiently to change the focus, the effect would be measurable at the screen as a slight enlargement or reduction in the size of the projected image of the film-gate aperture.

Although it is true that changes in the refractive index of glass caused by changes in temperature can be measured under the most exacting laboratory conditions, these effects are much too small to be discernible in theatre projection. In fact, from the practical point of view, temperature effects are important only in the wavelength calibrations of spectroscopes and monochromators.

Both visible light and invisible infrared rays are absorbed and converted into heat by the opaque silver particles of black-and-white emulsions. The dye images of color films, on the other hand, transmit the infrared radiation and are heated by the visible rays alone. Accordingly, color prints buckle less, and give less trouble from focus drift, than monochrome prints under identical heat conditions.





It may be assumed that the hot beam of light passing through a projection lens would cause an expansion of the individual lens elements, and that this expansion is greatest in their central zones. This is a reasonable and correct assumption, but we must not stop here. At any rate (ignoring the very slight effects of a small decrease in the density and refractive index of the glass), the resulting increased curvature of the positive elements and decreased curvature of the negative elements increases the overall refractive power of the combination lens and shortens its effective focal length (E.F.).

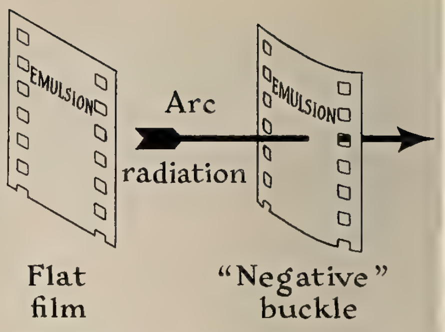
If the focal length of a lens were to shorten, the lens would have to be moved nearer the film to maintain a sharp focus on the screen. This is precisely what takes place as focus drift progresses—but do not be misled! A shortening of the focal length which exceeds the depth of focus of the lens would increase the size of the projected picture.

Since the depth of focus of the average lens ranges from 0.003 to 0.006 inch, the increase in picture width on a screen of average size would amount to a sizeable fraction of an inch, or more, and be measurable with a tape measure.

Glass, Brass, Aluminum

Glass is a poor conductor of heat. Nevertheless, it conducts approximately 0.002 calories per second through 1 centimeter across an area of 1 square centimeter for each 1° centrigade rise in temperature. In the course of a few minutes, therefore, considerable heat would flow into the brass or aluminum lens tube. Although brass conducts heat away 100 times faster than glass, and aluminum 250 times faster than glass, the metal of the lens tube nevertheless gets warm enough to expand. Brass expands under the influence of heat about twice as much as glass, and aluminum nearly three times, hence an appreciable lengthening of the lens tube.

A lengthening of a lens barrel *separates* the elements and *increases* the



Film which reaches the aperture in a flat condition begins to buckle "negatively" (toward the arc-lamp) the moment it is exposed to a flash of hot arc radiation which swells the emulsion relative to the supporting base material. Passage of the film through a HOT gate, however, softens the base sufficiently to aggravate the buckling and focus drift.

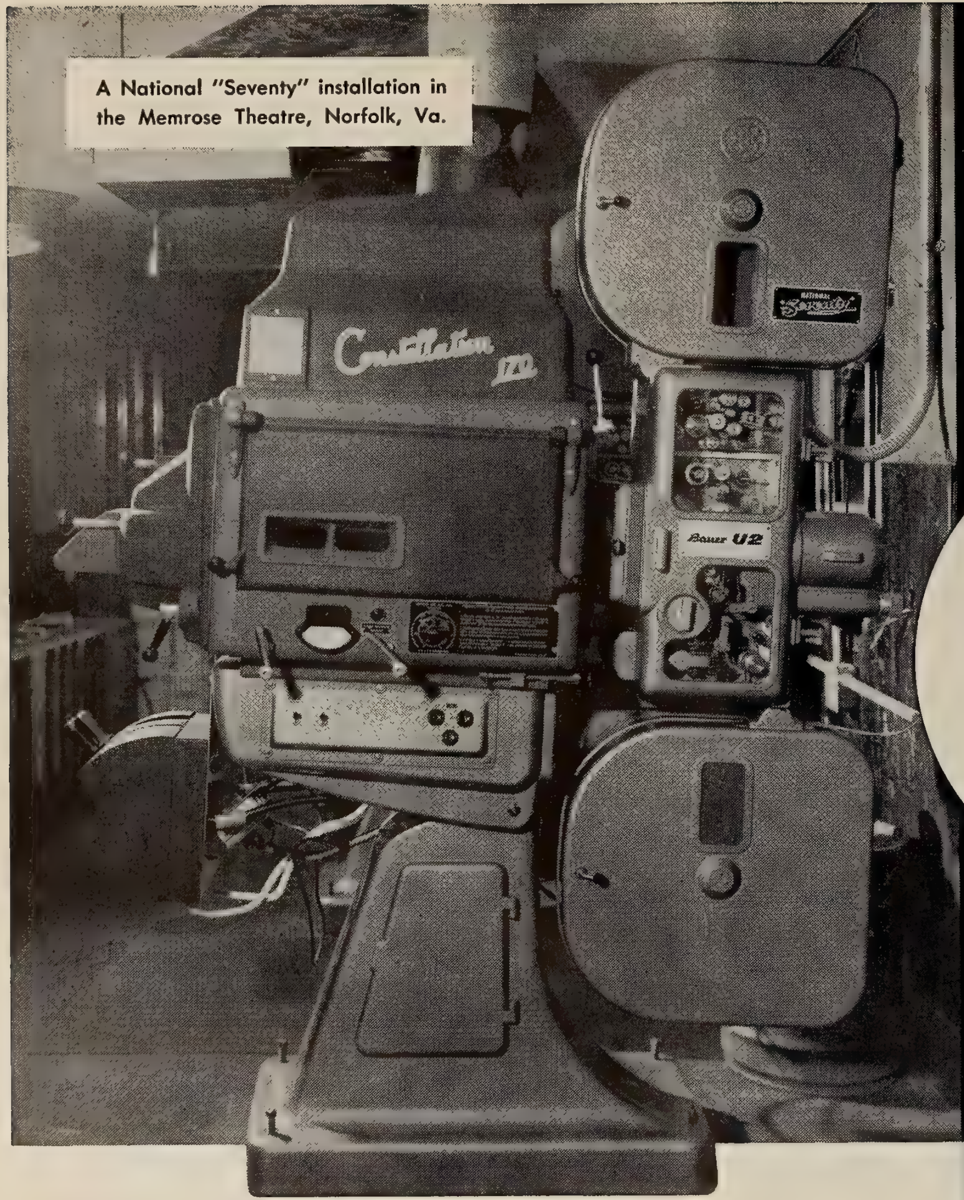
E.F. of the lens! The lens would now have to be moved farther away from the film, and the picture would be measurably smaller. *No effect such as this is observed during the progress of focus drift.*

We are forced to conclude that, whatever expansions occur in the lens elements and metal lens tube as a lens heats up, the individual effects are counteractive, and no appreciable change in the focal length of a projection lens occurs—no, not even under the most severe projection conditions. And we have facts to support this opinion.

Focus drift was formerly a serious problem in studio rear projection for motion-picture backgrounds behind live action. For one thing, the highest image definition is required in process projection. For another, the tremendously high arc amperages employed (180—250 amps in mirror or relay-condenser lamps) aggravates focus drift to a marked degree. Moreover, it is out of the question for a projectionist to keep hunting out a new focus during a "take."

The difficulty was overcome in more than one Hollywood studio by simply water-cooling the film gate of the process projector. The entire trap, aperture-plate, and film-rail assembly was maintained at a temperature only a little higher than room temperature even during long takes. The filtered light beam on the lens was just as hot as before (causing the assumed expansions of glass and metal), but there was no focus drift.

These observations may be confirmed without water-cooled gates by substituting a rigid metal plate punched with



A National "Seventy" installation in the Memrose Theatre, Norfolk, Va.

NATIONAL "Seventy" PROJECTION AND SOUND SYSTEM

the "70" with all the features!

70mm/35mm conversion in 2½ minutes!

The superb new design of the National "Seventy" permits truly hi-speed adaptability to any 35mm system—standard, wide-screen, Cinemascope, etc. With the "Seventy" you can schedule a program combining the two film sizes . . . converting from one to the other in a matter of minutes!

Special features of the National "Seventy":

- **Separate sprockets** are provided for each film width—single screw fastening of the sprockets means practically instantaneous removal.
- **Optical and magnetic sound** components are an integral part of the projector housing rather than separate "added-on" units.
- **Magnetic sound head** contains separate clusters for 4 and 6 channel sound reproduction.
- **Curved film gate** stabilizes focus and reduces film buckling. Adjustable tension of teflon runners assures steady projection with all film, new or old.
- **Lens mount** is rugged and exceptionally accurate—can accommodate any focal length lens for presentation of 70mm or 35mm.
- **Projector Drive** motor is connected directly to mechanism and provides for film speeds of 24 or 30 frames per second.
- **Automatic Circulatory Lubrication** eliminates need for special attention.
- **Cone type shutter** provides screen with maximum amount of light.
- **Motor-driven film take-up.**
- **Completely enclosed pedestal** tilts upward to 12° for drive-in use and downward to 30° for indoor use.

Call your National man
for complete specifications,
prices and delivery
on the "Seventy".

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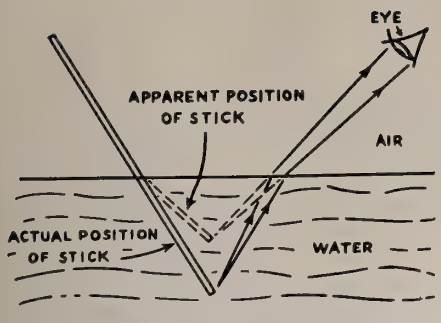


Classic representation of light refraction, mentioned in the accompanying article, is the displaced image of a stick in water.

a pattern of holes for the film. No matter how long the image of the plate is projected to the screen, no matter how hot the lens becomes, there is no perceptible alteration of focus.

Heat on Film the Culprit

The causes of focus drift are thus to be sought in the film and its reaction toward heat. Three distinct heating processes take place as film passes through the gate of a projector.

(1) Direct Irradiation. The individual frame areas of motion-picture film are each subjected to two quick flashes of intensely hot arc radiation within the space of 1/24 of a second in all rear-shutter projectors employing two light-cutoffs per frame (48 "light-flashes" per second). When the film is threaded in the normal manner for 35-mm prints (emulsion side toward the arclamp), the frame immediately assumes a "pincushion" shape, bulging toward the lamp, upon exposure to the heat-generating radiation.

Each frame accordingly expands lampward during the first flashing (1/96 sec.), contracts during the balancing cutoff of equal duration, and expands again during the second flashing. If the fluttery film buckling does not exceed the depth of focus of the lens, well and good: the focus is not impaired. Ordinarily, however, the flutter effect blurs the screen image when the arc current exceeds 60 amps. *without* heat filters, or 80 amps. *with* heat filters or "cold" mirrors, and when the lens E.F. is less than 5 inches.

This 48-cycle flutter of the film is caused by the expansion of the heat-absorbing emulsion relative to the heat-transmitting clear base, and is a normal occurrence. It is considerably less severe for color film than for black-and-white because the dye images of color film transmit the invisible infrared radiation which monochrome silver images absorb and turn into heat.

Water-Cooling a "Must"

(2) Conduction by Contact. Most of the heat absorbed by film usually comes from the hot gate film runners, not from radiation absorbed by the frame areas. Unless water-cooling is employed, the film rails get very hot after the projector has been running for several minutes, and the perforation margins are held against them rather firmly by the gate-door tension pads. Dye-image prints thus get almost as hot as silver-image prints when run through a projector having an uncooled gate no matter whether overall heating is reduced by heat filters or not.

Because conduction heats the film base as well as the emulsion, the film retains considerable warmth even after having been wound up on the lower reel.

(3) Secondary "Black-Heat" Irradiation. The entire picture and soundtrack area of the film begins to heat up when it enters an uncooled projector gate because the metal of the gate radiates long wavelengths of infrared (heat) which the film, separated from the metal only by the thickness of the runners (about 3/32 inch), absorbs.

It can be appreciated that film would be heated by passage through an *uncooled* projector gate even if there were no aperture to let light pass through! And the amount of heat taken up by the film is enough to soften it so that the lampward buckling induced by irradiation *at the aperture* is more severe than it would be if the film were cold.

Acetate Film Acts Better

It is worth remembering that the acetate film base used today softens more readily, and is on the whole less rigid, than the dangerously inflammable nitrate base used up until about 12 years ago. Nevertheless, even the more sturdy and brittle nitrate base is also "preconditioned" to buckle more severely by passage over the "trough" of hot metal from the top of the gate down to the aperture.

Some of us projectionists who can remember were justifiably alarmed whenever a power failure allowed the explosive nitrate film to stop dead in

(*Continued on page* 25)

'Zipper' Changeover Modified for Century 35/70 Head

The appended notes were obtained from Essannay Electric Mfg. Co., Chicago.

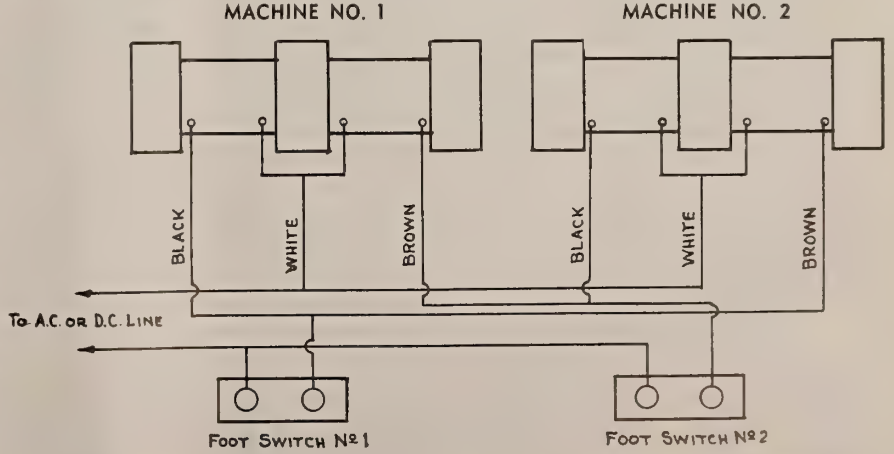
Century Projector Corp. had asked us to modify the design of an Essannay Zipper changeover to fit their new 35/70-mm projector head. The following changes were made:

The base of the regular Century casting was milled off flat with the back. The coil mountingscrew holes were changed and countersunk for flush mounting.

The pull rod was made longer.

The brass and steel armature sections were made longer to give greater stroke. The coil had been made shorter to give a minimum 2½-inch stroke. The coupling on the end of the flexible shaft was turned down to prevent interference with the tube bushing.

The 3 1/3 x 3 aluminum shutter is furnished by Century.



Two-machine wiring diagram for Essannay Zipper changeovers and footswitches.

LETTERS TO THE EDITOR

John Aalberg, Veteran

To the Editor of IP:

I enjoyed our SMPTE convention meeting recalling the old days of sound with you, one of the few who knew what was going on outside of the ivory towers. For our next session let us do the pre-sound era but without prohibition.

I have apparently only retired from the payrolls of the movies. My interest is still there working as a board member of the Academy of Motion Picture Arts and Sciences. This involves serving on many committees and keeping up with the business.

For some years and again this year, I have served as chairman of the Scientific and Technical committee which "Oscars" technical achievements. I attempt to in-include, at least for consideration, developments which affect theatre operation such as the high speed movement. Many factors come to play in this consideration and sometimes a development gets lost for reasons not apparent to the public. This year if any of the nominations pertain to the craft, I will bring them to your attention.

Daniel F. Haworth and Fred Beard, formerly of M-G-M and Todd AO, made the Research Council survey. Danny now is with Todd AO. Best regards and thanks for my night at the 25-30 Club.

John O. Aalberg
Los Angeles, California

NOTE: John Aalberg is a nationally known technician, a longtime member of Chicago projectionist Local 110, and more recently director of recording for RKO pictures.

Notched Torn Prints

To the Editor of IP:

We have an important exhibitor in Alaska who is using old Holmes 16-mm carbon arc projectors. It is our standard film inspection policy to notch carefully a sprocket hole rather than to splice, when damage affects only the area between the sprocket hole and the edge of the film and when only one sprocket hole is damaged.

We feel that this preserves the continuity of the film; we have never known this single-sprocket-hole notch to interfere with projection on the RCA 400 projectors we use, nor have we ever had a complaint except from this one customer.

Despite the extreme dissatisfaction of this customer, we told him that the problem he has with our notched sprocket holes is the fault of the design and the film tension of the old Holmes projectors —the only ones in Alaska, to our knowledge.

This customer is buying new equipment, because his old machines are worn-out anyway, and we assume that his problem will soon be a thing of the past. But in the interest of assuring that we are using the best possible inspection and repair methods, I would be grateful if you could give us your views on this question of single-sprocket-hole notching, as opposed to splicing when only the edge of one hole is torn.

Pictures, Inc.
611 N. Tillamook St., Portland, Oregon

IP has long advocated the smooth notching of torn perforations in 35-mm prints to avoid cutting and splicing the film. Because there are 4 sprocket holes per frame along both edges of 35-mm film, 2 or 3 consecutive holes can be cut away without endangering the smooth passage of the film through the projector. The sprocket holes of 16-mm sound film are nevertheless individually more important because there is only one per frame.

A notched 16-mm perforation could conceivably cause trouble in projectors having only a single pull-down tooth on the shuttle; most, however, have 2 teeth, and should carry a single notched perforation without difficulty.

Rounded Angle Requisite

To avoid any possibility of the notch catching on any part of the projector gate and tearing the film, the notch should be smoothly rounded and not cut at *too sharp* an angle. If it feels smooth to the fingers, it should not give any trouble in projection. Even though many sprocket projectors can handle film having as many as 3 consecutive perforations cut away, the fact that most 16-mm machines have claw movements should be taken into consideration, and no more than one sprocket hole cut away or notched.

Clear film-base perforation-margin patches can be cemented over torn sprocket holes when it is dsired to preserve valuable subject matter without the loss of a few frames in cutting and splicing.

Slow-Motion—How Come?

To the Editor of IP:

During the showing of sports events on TV, such as horse races, the picture is shown in standard speed; then parts of it will be re-run in slow-motion. The question is: How do they get slow-motion from standard film without flicker? What kind of a projector do they use that will remain in sync with the TV cycle? It does not seem feasible to use both standard and slow-motion cameras for the entire event.

I felt rather stupid when the question was asked, as I had not given any thought to this before, and just did not have any answer.

In an issue of IP (Sept. 1959, P. 16) there was an article on "Cinetarium" developed by somebody in Germany. If you will look back about two years, you will find an article in IP where I suggested the same kind of a theatre. I visualized the use of multiple projectors; whereas the German uses only one. I still have to be convinced that one will give ample light. I fail to see how it can on a dome of any size that will hold more than a few people.

They (?) just scoffed at my idea; but now someone else is making it a reality. That's the way the ball rolls.

J. G. Jackson
Port Alberni, B. C., Canada

ANSWER: An interesting question, indeed. There are several methods for producing slow-motion in movies. The speed of the projectors for TV transmission is not altered, although there are ways of doing this without producing the so-called "splice lines" which normally appear in the picture when the projector is out of sync with the scanning frequency. The most commonly used method of providing slow-motion shots from negatives photographed at the regular 24 frames-per-second rate involves the use of an optical "step-printing" machine.

The section of normal-speed negative desired in slow-motion is step-printed to produce, in the print, from 2 to 4 frames every single frame of the negative. That is, each frame in the negative is printed 2, 3, or 4 times consecutively. The resulting slow-motion is a bit "jerky," because every consecutive 2, 3 or 4 frames are the same. The motion can be arrested completely by printing many feet of positive from a single negative frame.

The smoothest slow-motion may be obtained only by "shooting" at a high rate of film travel. It is not necessary to have two cameras operating simultaneously to inter-cut from normal speed to slow-motion, however, because a slow-motion negative can be step-printed to give a perfect normal-speed print. In this case, every second, third, or ofurth frame is printed, the one in-between being omitted from the print.

Still another feat of movie magic performed by the step-printer is reversed motion, the negative being run backward while the positive raw stock is run forward. All of these "trick" films are shown at the regular 24 frames per second rate of film travel, of course.

This has been going on since 1917!

Yes sir, National Carbon Company has provided free screen lighting technical assistance to the industry since 1917. Today, 12 sales engineers—equipped with compact service kits containing the most modern tools in the trade—are ready to assist on any screen lighting problem you might encounter.

Use "National" projector carbons and call on NATIONAL CARBON for free technical service. It's a tough combination to beat—the best in product... the best in service. You'll realize the ultimate in picture quality at the lowest overall cost.

Each salesman's kit contains the following modern equipment: brightness meter, voltohmmeter, clamp-on ammeter, dummy lens, set of alignment rods and accessories, pin-hole apertures, split-plate aperture plates, stop watch, micrometer, ruler and slide rule.

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Harassed Exhibitor Turns to IP

Innumerable letters from exhibitors akin to that appended have been received by IP but never committed to print. IP's services in this area have been on a no-charge basis. Growing a little weary of exhibitor leaders proclaiming their devotion to raising projection standards, IP publishes this exchange.

Not generally known, and never broadcast by IP, is the intimate acquaintance by exhibitors with the content of this publication. In addition to some 200-odd exhibitor subscriptions direct-paid (IP has no solicitors) there must be several hundred other exhibitors who obtain copies regularly by devious means, most likely from projectionists who wish to direct attention to some pertinent item of technical information relating to either procedure or equipment which will raise presentation values.

The appended communication from an harassed exhibitor who, obviously sincere in his efforts to raise performance standards, was willing to back his notion that better projection pays with cash. Copies of his appeal to IP including name and address, have been sent to all service organizations; but his name and locale are omitted here to forestall the descent upon this hapless exhibitor of a horde of know-nothing, cure-all technical hacks.

In passing, IP recommends that projectionists continue the practice of passing on to exhibitors their copies of IP, not only as a means of spreading the technological gospel but as a boon to craft prestige in terms of having a paper of their own.—J. J. F.

To the Editor of IP:

I HAVE BEEN having trouble with my sound, even though we have a sound service contract with a reputable company and are supposed to be checked every six weeks. The sound reproduction is very poor. I believe that the service engineer knows his business, but he just fails to do a good job. He does not do half the things that he lists on his check-in report.

Even though I bought an expensive loudspeaker that, I was told, would improve the sound very much, it is getting worse, if anything. Our theatre is 48 feet wide, 80 feet from the back of the auditorium to the stage entrance. It has 720 seats, 520 downstairs and 200 in the balcony.

Could you recommend the proper size of amplifier, type of soundhead and speakers that one should have to get good high-fidelity sound? I am also looking for the proper information to improve the acoustics of the theatre.

Any data that you can give me would be appreciated. I am willing to pay a reasonable fee for the right information. I have been stung so much lately that I wish to try and be right when I do anything else.

Thanks so very much.

FRUSTRATED IOWA EXHIBITOR

By ROBERT A. MITCHELL

Contributing Editor, IP

WE BELIEVE you are being imposed upon by your present sound service engineer. Falsified reports and wilful neglect of important sound-system components constitute a breach of contract. See your attorney, or at least voice your complaints, loudly and in detail, to the home office of your service organization. If no satisfaction is offered, you can then feel free to seek sound service elsewhere.

As you can readily understand, it is impossible to diagnose sound troubles without hearing the sound, or to prescribe a cure without knowing what brand and model of equipment you have. If the soundheads and amplifiers are functioning properly, the speakers are at fault—the most common cause of sound quality which is neither good nor really bad but just annoyingly mediocre.

Projection Room Likely Spot

Because you say that your sound is getting worse despite the installation of a new speaker, we suspect that the cause of your trouble lies in the projection room. Now, soundhead and amplifier tests pose no problem to a sound engineer who knows his business and is conscientious in applying his knowledge. In fact, there is no excuse for his neglecting such tests when deteriorating sound quality demands them.

The logical thing to do first is to check the optical-tube focus in both soundheads. But if you have a "non-sync" for playing disc records, and the sound from that is also poor, the amplifier system is obviously at fault. An amplifier, as you know, consists of several stages which are sometimes treated as separate amplifiers and housed in separate cabinets. You thus have one or two "pre-amplifiers" (if two, there is one for each projector); a main "voltage-gain" amplifier, and one or more "power" amplifiers to step up the sound current to operate the speakers.

Because your theatre is of only moderate size, you probably have only one power amplifier; but this may contain as many as two power tubes (and possibly a phase-inverter tube if it is not transformer-coupled). If your system is quite modern, the voltage-gain and power amplifiers will be housed together in one cabinet; if your system is very old, with "racks" that look like a radio transmitter, these two amplifiers may be housed separately.

The Tube Situation

Naturally, we don't know what you have; we can only guess. But if you can locate the power tubes in the power amplifier, it will save you a great deal of time. Buy new ones of the proper type to replace the old tubes. The power tubes handle the most power and get the hottest because they feed the speakers. They are the first to wear out and cause weak, "mushy" sound.

If this doesn't do the trick, replace *all* of the tubes in *all* amplifiers. (Don't bother with the rectifier tubes at this point—the ones that supply direct current to the other tubes, to the photocells, and to the exciter lamps and speaker field coils—if you have old-style speakers.)

Play records on your non-sync for testing sound quality *if you are sure that the non-sync gives good sound when your system is functioning as it should.* This procedure saves time and eliminates the effects of soundhead maladjustment (which can be corrected later).

We hate to think of your buying new amplifier tubes ($15 to $50 worth) if you don't really need them—if your sound trouble is nothing more than out-of-focus optical tubes in the soundheads! You probably *do* need the new tubes; but if you *do not* have a record player for testing the sound independently of the projector soundheads, you had better get both soundheads in tip-top shape before tackling the amplifiers.

Tube Adjustment Critical

The azimuthal (rotational) and focus adjustments of the optical tubes are

extremely critical and delicate; but you can make them yourself, in a pinch, even without a loop of high-frequency test film. You must be very careful, take your time, and know what you are doing every step of the way.

Find a foot or so of film having high-frequency sounds recorded in the soundtrack. (This should preferably be a "variable-density" track having many fine sound lines, or striations, very close together in the track.) Thread this into the soundhead, turn on the exciter lamp, remove the photocell-housing cover so you can observe the spot of light on the photocell cathode plate, and follow the instructions by Robert A. Mitchell given in IP for October 1959 ("Care of the Optical Soundhead") or in his "Manual of Practical Projection" on pages 359-60.

Then, after you have obtained the best possible optical-tube focus, readjust the exciter lamp both up-and-down and sideways for the brightest spot of light on the photocell plate.

Photocells also deteriorate, although very slowly, as a rule. Test them by putting a new one into one of the soundheads to see if it makes any difference in the sound. (Probably it won't.) Also, you had better observe the photocells, with the covers of their compartments off, and with the sound system turned on for sound-on-film reproduction.

If the photocells are seen to glow with a faint bluish light, either the photocells are "dead" or something is radically wrong with the hookup in your preamplifiers.

Other Serious Trouble Spots

There are other, and more serious, things that can be the matter with your sound than out-of-focus opticals and bad tubes, of course. Normally, there is nothing in an amplifier to wear out except the tubes; and it is an easy job to replace them if you take care to get the right tubes in the right sockets. But a partially short-circuited coupling capacitor or bias resistor may require the services of a *new* service engineer or of a radio or TV repairman who is willing to take a chance on equipment with which he is not entirely familiar.

In checking over your system, don't neglect the speakers, even though you have recently had a new one installed. If the installation engineer failed to match the impedance of the combined speaker and crossover-network system with the impedance of the power-amplifier output transformer, your sound will be weaker than normal and more or less distorted.

But, again, we find ourselves at a disadvantage in attempting to offer advice; we simply don't know what you have. If only one speaker is involved, a 24-ohm output-transformer impedance requires a speaker voice-coil impedance of 24 ohms for the best results. If two or more speakers are involved, then the *total* speaker impedance must be the same as the output impedance.

Total Speaker Impedance

Total speaker impedance will depend upon whether the individual impedances are connected in series or parallel: formulas for computing these are given on page 426 of the Mitchell "Manual."

Certain makes of sound system employ a high output impedance (about 250 ohms) in order to minimize line losses to the speakers, which may have a combined voice-coil impedance of only 12 to 24 ohms, but a crossover-network impedance in the neighborhood of 225 ohms to match that of the output transformer.

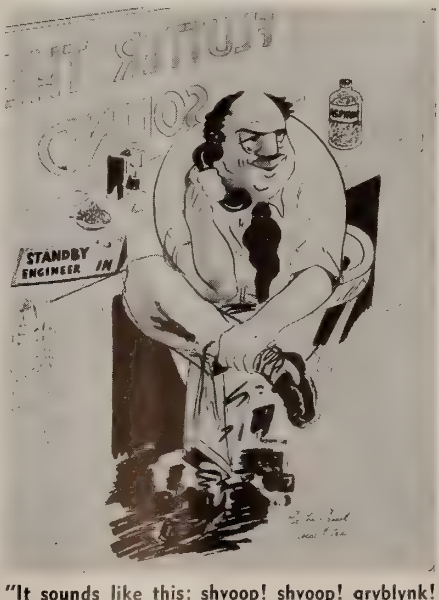
A 720-seat theatre requires a minimum power-amplifier output of 15 watts with less than 2% distortion for satisfactory sound power. This requirement is met by the smaller modern sound-system amplifiers (for example, the Simplex AM-1001 and the RCA MI-9251).

Cleaning M-M Striped Film

Motion picture films having the Minnesota Mining & Mfg. Co.'s laminated "Scotch Track" magnetic sound stripe require special care in cleaning.

Such films, according to a bulletin issued by The Calvin Co., Kansas City, Mo., should be cleaned *only* with a Freon-type cleaning fluid. Other liquid film cleaners have been known to loosen the adhesive bond between the stripe and the film. The bulletin also advises against winding laminated-stripe film on cores.

Call For Emergency Service



"It sounds like this: shvoop! shvoop! gryblynk! kerplunk! krrrk! Then a noise like an air-locked faucet, with a kind of terpucket, terpuket . . ."

Ed McCormack, Local 582, Brantford, Ont., Canada

VICOM Lens Adapter Cures S-F-L Ills

ONE of the best projection adjuncts to be developed in a long, long time is the Visual Image Compensator, termed "VIC" in the trade, which is an adapter lens intended for fastening onto the front of the normal standard (prime) projection lens in order to produce a resultant short-focal length lens one-half the focal length of the prime lens.

That this adapter accomplishes everything claimed for it by its designer and manufacturer was amply demonstrated to a group of projection technicians at the recent convention of the Society of Motion Picture & Television Engineers.

It is commonly known that present short-focal length lenses are not capable of projecting a good screen image because they are extremely difficult to keep in focus and also occasion a progressive loss of illumination and definition at the sides of the picture.

Long Focal Length Advantages

VIC and a long focal length prime lens will correct these faults in terms of flattening the field and producing a sharp picture from edge to edge with the even light distribution and depth of focus inherent in the *prime* lens being maintained.

For example a theatre which requires a 2½-inch lens may now use a 5-inch lens plus VIC. This would give the same screen size as the short focal lens but it will give the focus-depth of a 5-inch lens and also improve considerably the light distribution across the entire screen surface; in short, no fall-off toward the sides.

Demonstration units will be available shortly, along with a selection chart for both 35- and 70-mm applications. All details from VICOM, 800 Linden Avenue, Rochester 10, New York.

Interchange Color TV Tape Demonstrated by RCA

The interchangeability of color TV tape recordings—an eagerly awaited development in the TV industry—has been successfully demonstrated by RCA.

The new RCA color TV tape recorders have been designed so that a color tape made on one RCA machine can be played on another RCA machine. This eliminates the need for the current practice in color TV tape recording of storing the head assembly with the recorded material so that the same head can be used on playback.

A still further step was taken and an original color tape recorded on a non-RCA machine was played back over a closed circuit TV system by means of an RCA recorder.

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What's more, country-wide, people react pretty much the same. Mostly they like Westerns. If the story is good; if the stars are competent; if the photography really *has it,* they talk and—*young and old—flock to the box office!*

In other words, the better the picture the better the box office.

That's why close co-operation with the Eastman Technical Service for Motion Pictures is so important . . . why it pays to tap Eastman's background of experience—to check up on questions of film choice, production, processing. Offices at strategic locations. Inquiries invited.

It's what's on the screen...and what people say about it...that counts

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West Coast Division
6706 Santa Monica Blvd.
Hollywood 38, California

Saga of Free Service by National Carbon

Technical assistance on screen lighting problems was available for the asking from National Carbon Co. as far back as 1917—42 years ago! This would seem to put to shame the recent and sudden interest of theatre owners in those matters technological which were the sole source of their economic being.

Down through this dreary stretch of years (technologically-speaking) these birds were as unaware of the technical processes which enabled them to count cash the following morning as is a deaf mute to the spoken word.

Take a Number—1 to 12

In the early days of the then growing movie industry there was just one NCC field engineer; by 1925 there were two men on the job; today there are 12 sales engineers strategically located in plotted geographical areas throughout the country. The cumulative total of free service calls over the years is estimated to run into the hundreds of thousands.

"We are firmly convinced that free technical assistance on screen lighting is one of our major responsibilities," says J. W. Cosby, arc carbon sales manager for National Carbon Co. In most cases of requests for assistance, the engineer is in the projection room within a matter of hours, working with projectionists on the *many* variables involved in good screen lighting."

Finest, Modern Service Kits

In its most recent move to equip its field engineers with the most modern tools of their trade, NCC has invested many thousand of dollars in compact service kits now in use. These kits comprise the following equipment:

Brightness meter to measure foot-lamberts on the screen; foot-candle meter to measure *incident* light on the screen; volt-ohmmeter and clamp-on ammeter for checking electrical conditions at the arc-lamps; dummy lens and set of alignment rods and accessories designed for every carbon size and lamp now in service; pinhole apertures and split-plate aperture plates for a quick check on alignment; a stop-watch for checking on carbon burning rate; micrometer for carbon measurements, and a sliderule for making accurate calculations in the projection room.

"If such a service does nothing more than remind exhibitors of the importance of quality projection," continues Mr. Cosby, "it will have proven more than worth while. Projectionists are urged to avail themselves of this service."

NATIONAL CARBON CO. PROVIDES FIELD SERVICE BY THE DOZEN

The 12 arc carbon sales engineers representing National Carbon Company throughout the country prepare to leave their recent annual meeting equipped with new service kits. From left to right: J. B. Haynes, Kansas City; W. T. Brenner, Philadelphia; A. B. West, Boston; J. C. Naughton, Pittsburgh; S. Morley, Jr., San Francisco; G. H. Mayer, Atlanta; P. H. Freeman, New York City; C. W. Handley, Los Angeles; V. D. Johnson, New York City; W. T. Strother, Dallas; A. C. Halliday, Indianapolis; and C. E. Heppberger, Chicago.

25-30 Club's Great Meetings; Observing 20th Anniversary

The October meeting of the 25-30 Club had a big turnout to hear Dr. Frederick J. Kolb, Jr., and Bill Rivers of Eastman Kodak Co. make an oral and visual presentation of a most unlikely topic, "Weather in the Projection Room," but which proved to be of the utmost importance in terms of the effect of humidity on film. Great show.

Newly elected officers for 1960: Ben Norton, Joe Engle, Ben Stern, Morris J. Rotker, Nat Strauss, and Julius Wetzler. Citing his inability to continue as secretary, a post he has filled for 19 years, Morris J. Klapholtz was promptly and unanimously elected the first honorary past president in the Club's history.

Far-Ranging Visitors

Visitors included Clyde Cooley, business representative of Omaha, Neb., Local 343; E. M. Lewis, Ampex Corp., Redwood City, Calif., and member of both Local 252, Sacremento, and Local 50, Hollywood; and John O. Aalberg, longtime member of Chicago Local 110 and more recently director of recording for RKO Pictures.

At the next meeting Bill Nafash, projection supervisor at the recent U.S. exposition in Moscow, will give the lowdown in words and pictures of how the Russians handle things cinematic. Club's 20th anny party as this IP goes to press.

Holmes and Lumen Co. Merge

Holmes Projector Corp., of Chicago, Ill., merged with the Lumen Co. of Joliet, Ill., and has moved its plant to the latter city. Oscar J. Holmes, pioneer projector manufacturer, has been named chairman of the board of the new company, with B. F. Pfeiffer as president.

A camera that fits into the thin, leading edge of a Convair F-106 airplane wing to take 20 pictures every second during a target strike was described at the same meeting. The strike camera was cited as an example of critical design needed for instrumentation cameras.

Requirements in design of the camera include an optical system automatically directed toward the line of flight; resistance to G-loads, temperature extremes, and vibration; and right- and left-hand versions of the camera, so pictures taken from each wing combine to give a full, wide-angle view.

LENS CHART FOR 35-MM

One of the most confusing things in establishing proper indicia is the introduction of larger film (70-mm), different aperture widths, varying lens focal lengths; then there are the drive-ins which by reason of their long throw and enormous screen sizes require a quite different set of optical values.

Now being prepared is a table which will be definitive for 70-mm and drive-in projection. On the flanking page is the most recent Projection Table which shows the proper screen images at different distances (throw) with lenses of different focal lengths. *REMEMBER:* these figures are based on a STATED aperture dimension, any variation from which would necessarily alter the tabulation.

IP in particular, and the craft in general, are indebted to BAUSCH & LOMB OPTICAL CO., Rochester, N. Y., for making available these data.

This Table For Standard 35-mm Projection Only

PROJECTION TABLE

showing size of screen images at different distances with lenses of different focal lengths.

PICTURE APERTURE: 0.825″ x 0.600″

	PROJECTION DISTANCE—FEET																
Focal Length Inches	*40′*	*50′*	*60′*	*70′*	*80′*	*90′*	*100′*	*110′*	*120′*	*130′*	*140′*	*150′*	*160′*	*170′*	*180′*	*190′*	*200′*
2.00	16.4 11.9	20.5 14.9	24.6 17.9	28.8 20.9	32.9 23.9	37.0 26.9	41.1 29.9	45.3 32.9									
2.25	14.6 10.6	18.3 13.3	22.0 16.0	25.6 18.6	29.2 21.2	32.9 23.9	36.6 26.6	40.2 29.2	43.9 31.9	47.5 34.6							
2.50	13.1 9.6	16.4 11.9	19.7 14.4	23.0 16.8	26.3 19.1	29.6 21.5	32.9 23.9	36.2 26.3	39.5 28.7	42.8 31.1	45.6 33.5						
2.75	12.0 8.7	15.0 10.9	17.9 13.0	20.9 15.2	23.9 17.4	26.9 19.6	29.9 21.8	32.9 23.9	36.0 26.1	39.0 28.3	42.0 30.5	45.0 32.7	48.1 34.9				
3.00	10.9 8.0	13.7 10.0	16.4 11.9	19.2 14.0	22.0 16.0	24.6 17.9	27.4 20.0	30.2 22.0	32.9 23.9	35.7 25.9	38.4 27.9	41.1 29.9	43.9 31.9	46.7 34.0			
3.25	10.1 7.3	12.7 9.2	15.2 11.0	17.7 12.8	20.2 14.7	22.8 16.6	25.3 18.4	27.8 20.3	30.4 22.1	32.9 23.9	35.5 25.8	38.0 27.6	40.5 29.5	43.0 31.3	45.6 33.1		
3.50	9.4 6.8	11.7 8.5	14.1 10.3	16.4 11.9	18.8 13.7	21.1 15.4	23.5 17.1	25.9 18.8	28.3 20.5	30.5 22.2	32.9 23.9	35.2 25.5	37.5 27.3	39.9 29.0	42.3 30.8	44.7 32.5	47.0 34.2
3.75		10.9 7.9	13.1 9.6	15.3 11.1	17.5 12.8	19.7 14.4	22.0 16.0	24.0 17.6	26.3 19.1	28.6 20.7	30.7 22.3	32.9 23.9	35.2 25.6	37.3 27.2	39.5 28.8	41.7 30.3	43.9 31.9
4.00		10.2 7.4	12.3 8.9	14.3 10.4	16.4 11.9	18.5 13.4	20.5 14.9	22.6 16.4	24.6 17.9	26.7 19.4	28.8 20.9	30.8 22.4	32.9 23.9	35.0 25.4	37.0 26.9	39.1 28.4	41.1 29.9
4.25		9.7 7.1	11.7 8.5	13.5 9.8	15.5 11.2	17.4 12.7	19.3 14.0	21.2 15.4	23.2 16.8	25.2 18.3	27.1 19.7	29.1 21.1	30.9 22.5	32.9 23.9	34.9 25.3	36.8 26.8	38.8 28.8
4.50			10.9 8.0	12.8 9.3	14.6 10.6	16.4 11.9	18.3 13.3	20.1 14.6	22.0 16.0	23.7 17.2	25.6 18.6	27.4 20.0	29.2 21.2	31.0 22.6	32.9 23.9	34.8 25.3	36.6 26.6
4.75			10.4 7.6	12.2 8.9	13.9 10.1	15.7 11.4	17.3 12.6	19.0 13.0	20.7 15.1	22.5 16.4	24.2 17.6	26.0 18.9	27.6 20.1	29.4 21.4	31.1 22.6	32.9 23.9	34.7 25.2
5.00				11.6 8.4	13.1 9.6	14.9 10.8	16.4 11.9	18.1 13.2	19.7 14.4	21.4 15.6	23.0 16.8	24.6 17.9	26.3 19.1	27.9 20.3	29.6 21.5	31.3 22.8	32.9 23.9
5.25				10.9 7.9	12.5 9.1	14.1 10.3	15.7 11.4	17.2 12.5	18.8 13.7	20.3 14.8	21.8 15.9	23.5 17.1	25.1 18.3	26.7 19.4	28.3 20.5	29.8 21.7	31.3 22.8
5.50				10.5 7.6	12.0 8.7	13.5 9.8	15.0 10.9	16.4 11.9	17.9 13.0	19.4 14.1	20.9 15.2	22.4 16.3	23.9 17.4	25.4 18.5	26.9 19.6	28.4 20.6	29.9 21.8
5.75					11.3 8.3	12.8 9.3	14.2 10.3	15.7 11.4	17.1 12.4	18.6 13.5	20.0 14.5	21.4 15.6	22.9 16.6	24.3 17.7	25.8 18.7	27.2 19.8	28.6 20.8
6.00					10.9 8.0	12.3 8.9	13.7 10.0	15.1 10.9	16.4 11.9	17.8 13.0	19.2 14.0	20.5 14.9	22.0 16.0	23.3 17.0	24.6 17.9	26.0 18.9	27.4 20.0
6.25					10.5 7.7	11.9 8.6	13.1 9.5	14.3 10.4	15.9 11.4	17.0 12.4	18.4 13.3	19.7 14.3	21.0 15.3	22.3 16.2	23.6 17.2	25.0 18.1	26.3 19.1
6.50						11.4 8.3	12.7 9.2	13.9 10.1	15.2 11.0	16.4 11.9	17.7 12.8	18.9 13.7	20.2 14.7	21.5 15.6	22.8 16.6	24.0 17.5	25.3 18.4
6.75						10.9 7.9	12.2 8.8	13.4 9.8	14.6 10.6	15.9 11.6	17.0 12.4	18.3 13.3	19.5 14.2	20.7 15.1	22.0 16.0	23.2 16.9	24.4 17.8
7.00						10.5 7.6	11.7 8.5	12.9 9.4	14.1 10.3	15.3 11.1	16.4 11.9	17.5 12.8	18.8 13.7	19.9 14.5	21.1 15.4	22.3 16.2	23.5 17.1
7.50							10.9 7.9	12.0 8.7	13.1 9.6	14.2 10.3	15.3 11.1	16.4 11.9	17.5 12.8	18.7 13.6	19.7 14.4	20.8 15.2	22.0 16.0
8.00							10.2 7.4	11.2 8.2	12.3 8.9	13.3 9.7	14.3 10.4	15.4 11.2	16.4 11.9	17.4 12.7	18.5 13.4	19.5 14.2	20.5 14.9
8.50								10.6 7.6	11.7 8.5	12.6 9.1	13.5 9.8	14.5 10.5	15.5 11.2	16.4 11.9	17.4 12.7	18.4 13.4	19.3 14.0
9.00									11.0 8.0	11.8 8.6	12.8 9.3	13.7 10.0	14.6 10.6	15.5 11.3	16.4 11.9	17.3 12.6	18.3 13.3

Sizes given are to the nearest tenth of a foot.

For projection distances over 200 feet, select the distance which is one-half the required length and double the image sizes

"Safety in the 'Booth'"—as She is Not

From time to time there appear in other publications seemingly authoritive articles purporting to deal effectively with basic projection problems. While IP certainly is not responsible for some of the vapidities anent this problem, it most certainly must take cognizance of a recent column appearing in an exhibitor paper which purports to give an "authoritative" exposition of "Safety in the Booth"—*booth,* no less. Here it is.

IN the article "Safety in the Booth," the writer is overly anxious to spread the erroneous impression that theatre fires originate in the projection room. This was not true even in the days of nitrate film. Most theatre fires originate in the cellar, backstage, or in the furnace room—everywhere, in fact, except in the projection room.

Now that the film is made of material which is considerably less flammable than ordinary paper, the projection room is the safest place in the theatre. The equipment and furnishings are fireproof, the room, itself, is fireproof, and no flammable materials are normally to be found in a theatre projection room.

Danger Downstairs, Not Upstairs

The manager's office is 100 times more of a fire hazard than the projection room. The popcorn machine is many times more dangerous than a motion-picture machine, and the electric display signs in the lobby and on the marquee are more of a fire hazard than an arclamp.

Most fires which have occurred in projection rooms were accidental, but not the result of carelessness. Present-day film will *not* burn or smoulder unless a continuous supply of heat is applied to it. Modern acetate film is completely safe, and is incapable of igniting even should a frame burn through in the projector.

Film fires with nitrate film (no longer used) usually occurred *outside* the projectors, according to the records of fire and insurance departments. Most film fires occurred on or near the rewinder and film storage cabinets. Contact of nitrate film with heaters and unenclosed motors and switches was responsible for the majority of disastrous film fires.

Aside from laws and regulations to the contrary, smoking in the projection room is no longer a source of danger. Laws prohibiting smoking in the room should be repealed, while new laws prohibiting the use of nitrate films in theatres should be enacted here as they have been in most European countries.

Possible Damage to Projector

Film in poor condition is hardly a fire hazard, now that film can burn only with great difficulty, and not at all unless kept heated by an extraneous fire. The danger of bad splices is to the projectors. Film breaks may strip the gears or otherwise damage delicate mechanisms.

Fire drops over the port openings are obsolete and need not be installed in new projection rooms unless obsolescent laws demand them. No need for their use will ever arise. The precautions to be observed in the storage of flammable cleaning fluids are precisely the same as those which any intelligent person would observe when storing these materials in his own home. The difference is that gasoline, acetone, alcohol, *etc.*, are more dangerous in the home. Apartments and dwelling houses are not absolutely fireproof; projection rooms are.

Organic Solvents Barred

But whatever use is made of alcohol in the projection room, neither it nor any other organic solvent should normally be employed for cleaning lenses: (1) Commercial alcohol and other solvents usually contain waxy and greasy impurities which soil lenses. (2) The gaskets and seals of lenses may be injured by organic solvents; and if the solvent works into the lens, it may frill and blister the Canada balsam used for cementing lens elements together.

Magazine rollers should be kept in good working condition simply because they are there: triacetate film does not burn, hence their function as fire stops belongs to the olden days of flammable nitrate film.

Enclosed Projectors Unnecessary

Magazine, mechanism, and soundhead doors need no longer be *always* closed. There is sometimes good reason to operate a projector with these doors open to observe the travel of the film when a defect in the operation of a projector is suspected. In any case, leaving these doors open poses no fire hazard: to repeat, film does not burn unless helped along by a blowtorch or bonfire. Like many other characteristics of American projectors and American projection practice, the totally enclosed projector is a relic of the horse-and-buggy days, as is this "expert's" curiously anachronistic recital of imaginary safety measures.

The European-type open mechanism has suddenly attained a very modern character, and is, besides, more popular with projectionists the world over than the cumbersome, boxlike, many-doored construction which typifies old-fashioned projectors.

Here's an Exhibitor Who Must Read IP—And Does

Focus changes continually in a projector. This factor accounts for much projection difficulty. When a projector is cold and the lamps are struck, heat builds up, changing the focus until a plateau of temperature is arrived at. But then when the picture is in focus, and a changeover made to the other projector, the problem of focussing presents itself all over again. Automatic focussing eliminates this.

Favors Head-On Projection

I am known as also a backer of head-on projection. His Panorama installation was rated superior. But at that changes had to be made. Faced with an 11-degree angle of throw, it was found that the 13-foot curve of the screen was causing distortion, so the curve was reduced to 7 at the center.

W. R. HOUCK

New Orleans, Louisiana

[NOTE: Anytime Mr. H. shows us an "automatic" focusing device, we'll eat it. See article by Robert A. Mitchell on page 5 of this issue.]

Diamond Carbon Advances

The development of a 13.6-mm rotating projector carbon that burns slower while providing better light distribution is announced by Arthur Worth, sales manager of Diamond Carbons. The new carbon is especially important in the projection of wide-screen films in both indoor and outdoor theatres, where improved lighting and lower operating cost are essential factors.

The improvements are also features of Diamond's 10- and 11-mm carbons. Diamond Carbons are available through all theatre supply dealers. New sales offices of Ringsdorff Carbon Corp., distributors of Diamond, are at 15 West 44th St., N. Y. City.

Another Magnum Opus

"Ben Hur," reputed to have cost M-G-M $15 million, has been cut the 1,100,000 feet shot to 19,000 feet and will run for 3 hours and 37 minutes. World premiere at Loew's State, New York on Nov. 18. Only "Gone With The Wind (3 hours and 40 minutes) and "The Ten Commandments (3 hours and 39 minutes) were longer.

The aforementioned cost of "Hur" does not include prints and advertising. Each print in 70-mm will cost at least $8,000 which, on an initial order of 60 prints will cost $480,000. M-G-M reportedly is asking for 70% of the theatre's take (apart from rather thin "operating" allowance) and the house will retain (they hope) 30%.

AUDIO - VISUAL
EDUCATIONAL • INDUSTRIAL • COMMERCIAL

Film-Conservation Program for Schools

THE START of a new school year is a good time to re-examine audio-visual techniques and procedures. In which ways was the use of AV materials unsatisfactory last year? Can a substantial improvement be effected? The loss of valuable classroom time by frequent film breaks during 16-mm showings is an expensive and unnecessary nuisance. Students learn nothing from a dark screen and a silent loudspeaker!

All films for school use should be inspected and repaired *before* projection, just as professional 35-mm theatre films are. The AV supervisor can thus learn from the professional projectionist a valuable lesson which will help conserve the busy teacher's time and patience as well as the film.

Projector Maladjustment at Fault?

Why are so many 16-mm instructional films in atrociously bad physical condition when received by the teachers who are to show them? Much of the blame may be attributed to the use in many schools of worn, maladjusted projection machines operated by persons who are not always as familiar with good projection techniques as they should be.

One cannot reasonably expect every teacher to be a projection expert, but it is only good sense to assign responsibility for the care and repair of the school motion-picture projectors to a person who has the time, the facilities, and the technical know-how to detect mechanical faults which may interfere with the quality of the pictures and sound, and which may tear or scratch the films. Such flaws, discovered early, may be corrected by the equipment custodian or, if serious, by an experienced repairman who has at his disposal an adequate stock of tools and spare parts.

The specific projector defects which are definitely known to damage film range all the way from accumulations of dirt in the projector gate to worn pull-down claws and edge-guiding rails. Therefore:

Precautionary Procedures

1. Make certain that the projector will be operated by a person who is familiar with the location and proper use of all controls and adjustments, who has previously demonstrated his ability to thread film into the machine, and who is likely to handle both the sound-projection apparatus and the films with practiced skill. Student projectionists should be thoroughly trained.

2. Be sure that all film-contacting parts (gate runners, gate pressure plate, gate edge-guiding rails, all sprockets and sprocket shoes, the sound drum, and all idler and snubber rollers) are free from dirt and grime. Clean these parts only with lintless cotton cloth, an orangewood stick, and "Carbona" cleaning fluid (which is used only when necessary, and very sparingly, for the removal of grease and stubborn deposits of gelatin emulsion and film wax).

3. Inspect all film spools, or reels, for bent flanges which may cinch or scratch film and interfere with take-up action. *Never use bent or damaged reels!*

4. It is extremely important to inspect *very carefully* two film-gate parts in particular, and to have the repair serviceman replace them *immediately* when they show signs of wear. These are the intermittent pull-down claws, which in time become hooked and tear the film perforations, and the lateral-guide rails which press against the edges of the film in the gate. When the guide rails become grooved, film splices may jam and pull apart in the gate. Sprocket teeth should also be inspected at intervals, as they may become hooked after many years of use.

5. Instruct the operator to check and double-check the threading of the film before turning the projector motor on.

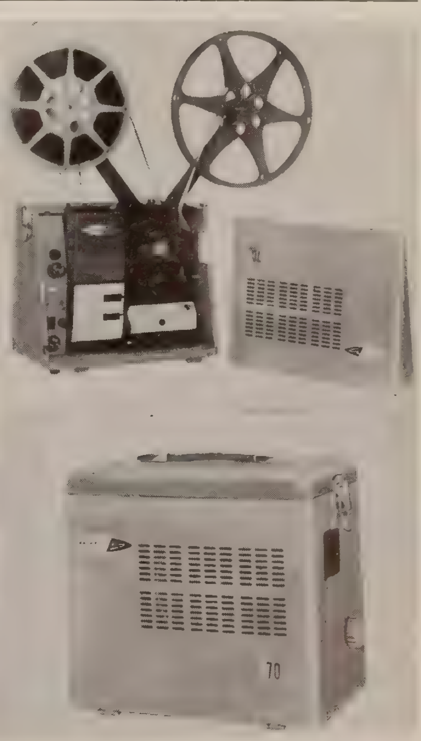
Motor Start and Stop

6. If the projector has no automatic "fire shutter" or safety device to guard the film from the blisteringly hot light rays should the film stop in the gate, the operator must be warned never to turn on the lamp until the film is running at normal speed, and never to stop the motor without first turning off the lamp. Unless special means are provided for the safe projection of single film frames as still pictures, failure to heed this precaution may result in scorched film and burned-out frames.

It must be stated again that no film should ever be projected without first inspecting it for tears and breaks, weak or otherwise faulty splices, and torn sprocket perforations.

The sprocket holes of a 16-mm sound film are subject to excessive wear and damage for two reasons: (1) there is only one perforation per frame, and (2) claw-type intermittent movements are much more wear-inflicting than sprocket intermittents. *Worn* perforations cause the pictures to jump and weave. *Torn* perforations result in loss of the lower film loop and, in consequence, an annoying displacement of sound synchronism which destroys all illusion of naturalness.

Sections of film containing severely damaged perforations should be excised and the good film rejoined by splicing. Weak or improperly made splices and all torn sections should also be removed. To last for the life of the film, splices should be made with fresh film cement on a good splicing block. Scrape the emulsion and gelatine binder from the



NEW KALART-VICTOR 70-15 PROJECTOR

Upper: projector set up for operation with speaker door at right. Lower: complete projector in single aluminum case.

film stub, apply an adequate quantity of cement with one stroke of the brush, and clamp the overlapped ends of the film firmly together with even pressure for 10 or 15 seconds.

The Checking-Through Process

Do not make splices with unwieldly, stiff full-frame overlaps, and do not use cellulose adhesive tape for mending motion-picture film.

Film is checked for defects by lightly contacting the edges with thumb and forefinger while rewinding it *slowly* from one reel to another. A hand-rewinding set is best for inspection and repair; and the splicing block may be placed between the two components of the set. The hand rewinder may also be used for cleaning soiled film and lubricating new prints or reversal originals.

Draw the film slowly through a soft, lint-free cloth (cotton or velvet) moistened with commercial film cleaner, Freon-113, or carbon tetrachloride. Although "carbon tet" is dangerously toxic, it is the ideal cleaning agent for all types of film—black-and-white, color, and magnetically-striped films.

Use carbon tetrachloride only in a well-ventilated room. Scrupulously avoid inhalation of the vapor and unnecessary contact of the liquid with the skin. Carbon tet poisoning is insidious, and may result in death days after exposure. Kodak Film Cleaner is completely free from carbon tetrachloride, is equally effective as a cleaner, and highly recommended for all types of film.

Proper Cleaning Procedures

The cloth moistened with cleaning fluid can be folded over the film and held in the left hand while the right hand is used to operate the rewinder *very slowly* to permit the liquid to evaporate before the film is wound up into the roll. Change the cloth frequently to avoid possible scratching of the film by accumulated dirt particles.*

There should be no concern, when cleaning color film, if some dye is observed on the cleaning cloth. This dye is only a film surface accumulation and not part of the dye picture image.

Old "seasoned" films do not normally require relubrication even after thorough cleaning. The emulsion of new, freshly processed film, however, is relatively soft and benefits by the judicious application of carnauba wax, stearate wax, or beeswax. If beeswax is chosen, cut off a piece the size of a pea, break it up into fragments, and dissolve in 4 ounces of tetrachloride or other film cleaner. Allow several hours, with frequent shaking, to dissolve the wax.

The wax is applied by the same aforementioned method outlined for cleaning film. The wax remains on the film after the fluid evaporates. Application of the lubricant should be made sparingly to avoid mottling and streaking. (Gentle buffing with a soft cloth will remove any streaking caused by accidental over-application of lubricant.)

Film Protection Leaders

A long leader of opaque film (black developed film or undeveloped "raw stock") should be spliced to the beginning of each reel. This leader is intended to be used for threading, and it should be replaced with a new leader when it becomes torn through long use or careless threading. A long runout trailer spliced to the end of each reel will protect the last scene in rewinding and cleaning.

Undeveloped raw film is ideal for "protection" leaders and trailers because its opaque yellow-white emulsion may be written upon with ink. Each leader and trailer should have inscribed upon it in *large* letters the following information:

1. Head (or Tail).
2. Sound Film (or Silent Film). (If magnetic track, so state.)
3. Name of Picture.
4. Number of Parts.
5. Part Number.
6. Running Time.

Films belonging to the school should be kept in dust-tight cans or boxes and stored in a cool closet. Do not overload reels, and never tighten loose rolls by pulling down on the free end. "Cinched" film is usually scratched film.

* While single reels of 16-mm film can be satisfactorily cleaned by following the procedure given here, professional projectionists are cautioned against attempting the much more difficult chore of hand-cleaning reels of 35-mm theatre-release films in the projection room.

Q. Can I Continue to Play Reels from my Extensive Two-Track Library with Machines Equipped with the New Four-Track Heads?

A. Yes.

New 4-Track Stereo Tape

By HERBERT L. BROWN

Magnetic Recording Industry Assoc.

SPEAK knowingly of "four-track" or "quarter-track" and you are in the wonderful world of stereophonic sound, for those are the terms used to describe the newest advancement of the magnetic tape recording industry to create stereo music. Whether it's called four-track or quarter-track it is simply two-track stereo in one direction and two-track in the other—a total of four tracks.

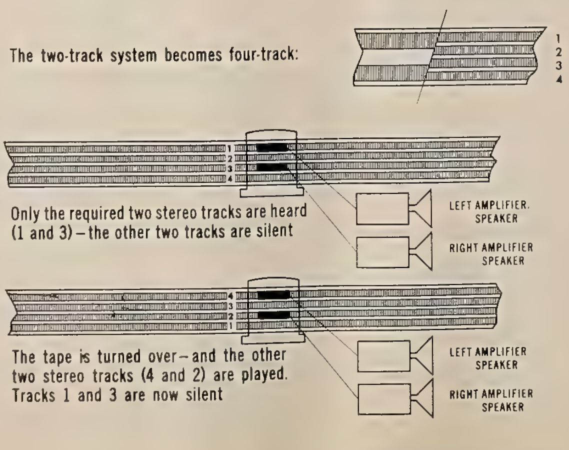
Think of it as two stereo tracks (played through the tape machine's two electronic channels) multiplied by the two times the one piece of tape runs through the machine. During the first run, only the required two tracks are heard. The other two are silent. The direction of the tape is reversed; the two remaining tracks are played, and the first two are silent.

Several Major Advantages

This new method of recording offers compactness, economy and functional ease that heretofore has not been possible with tape. An important benefit to the consumer is that the cost of the tape itself is cut in half since the four-track process doubles the length of playing time of any tape. Since the tape is played in both directions, no rewind is necessary. All machines wind tape more smoothly on the play-takeup reel, an additional advantage automatically achieved.

A number of major improvements within the past two years have made it possible to reduce track width and place four tracks on the quarter-inch tape—and yet maintain the same fine performance possible earlier only with the two-track system.

Further refinement in the mechanical aspects of the tape recording machine, more perfect head gaps, as well as improved raw tape and better recording techniques have all combined



Schematic of the new four-track stereo magnetic tape and how it works.

to make four-track the outstanding thing it is today.

The four-track concept is now used by manufacturers of both reel-to-reel recorders and cartridge machines. Speeds of the two differ, however, and the preponderance of recorded tapes scheduled for retail delivery this fall is 7½ inches per second. The speed of the new cartridge is 3¾ ips.

Current Recording Trend

The large recording studios in New York and Los Angeles use three channels and usually three tracks on half-inch wide tape to gain flexibility in making up the final two-track stereo tapes. The movies, not to be outdone, have used up to six channels in such wide-screen pictures as "Eighty Days Around the World" and "South Pacific."

* * *

Slide Operation For Free

James Cudney and Roxor Short of the International Cooperation Administration (U.S. Govt.) haven't bent their thinking to terms of theatre use as yet, but they are quite pleased with their success in developing a slide projector than can be built for five dollars and operated, well, for nothing. It's powered by sunlight and has been used in remote parts of Afghanistan where no electrical power is available.

Two eyeglass lens blanks are used for projectors, a condenser has been installed, and the light is obtained from the sun by proper placement of a flat mirror. It handles 35-mm film strips or 2 x 2 slides.

* * *

1960 Educational Film List From Indiana University

Indiana University's Audio-Visual Center has released its 661-page "1960 Educational Motion Pictures Catalog" listing approximately 6,000 films of cultural, social, and educational value, recommended for use from nursery school through college and adult levels.

The publication is an easy-to-use descriptive index to the 16-mm films in the University film library that are available on a rental basis to any responsible individual or organization. Address requests to Circulation Dept., Audio-Visual Center, Indiana University, Bloomington, Indiana.

The current catalog replaces the 1956 catalog and its three supplements. The library's 16-mm educational motion pictures are arranged in the publication both by suggested subject-matter areas and alphabetically by title. In both sections recommended grade levels are given.

Canada's Pay-TV Systems' Battle Lines Joined

THE world's first toll-TV system, Rediffusion, Inc., of Montreal, has developed its own machinery for a coinbox method and may try it in 1960. Rediffusion has been overlooked in the general discussion of pay-TV in Canada which the Telemeter project, to begin operation in Toronto at Christmas, has provoked.

The distinguished features of the two systems is that Rediffusion uses a weekly collection method, while Telemeter will rely on the coinbox when it begins its first permanent operation at Etobicoke, Toronto suburb.

Comparative Service Charges

Rediffusion, which is also by wire and uses Bell Telephone facilities, has 15,000 subscribers for $3.75 weekly and represents an investment of about $5 million to date. Telemeter will open with 4500 subscribers and will be able to service about 13,000 by the end of the winter. Both Rediffusion and Telemeter charge a $5 installation fee. The original Rediffusion charges were a $100 installation fee and $4.60 weekly, a TV set, property of the company, went with the service. Rediffusion subscribers pay monthly.

The Rediffusion customer gets TV channels, radio stations and recorded music, all of which is available on the TV set which comes with the arrangement—along with motion pictures originating in its own studio. At present, Telemeter's programming calls only for movies, but they will be second-run and thus generally newer than those of the Montreal operation. Rediffusion now also offers its service to people who own their own sets.

Rediffusion Forges Ahead

Rediffusion predicts that it will be a "long-term" proposition, as are most pioneering projects. In 1953 there were 3000 subscribers; now there are 15,000. The annual report of the parent company says that the Montreal subscribers doubled in the last 12 months.

Is the home collection method more precarious economically than the coinbox one? This was suggested by Telemeter representatives at its New York demonstration last year. Rediffusion denies it.

Heat-resistant ceramic which transmits light and can be pressed into any shape during manufacture, is expected to extend range of instruments now limited by heat resistance of their components, such as high-intensity incandescent lamps. Made from powdered aluminum oxide, ceramic may also be used in infrared lamps for testing heat-resistance of missile nose cones.

"Resolving Power" Not It Re: Lenses, Emulsions

Resolving power has been found unsuiable as a criterion of quality for lenses and photographic emulsions—Fred Perrin, Eastman Kodak Co.

"Ever since the lens was invented by the ancient Assyrians," Perrin said, "the quality of lenses and other optical systems has been judged by their ability to make distinguishable images of extremely fine lines lying very close together. After photography was invented, the quality of photographic films was determined in the same manner.

"Within recent years it has been found that this method of estimating quality is not satisfactory and might even be misleading. On the one hand, it is sometimes possible to see extremely fine lines with a microscope although the entire picture is unpleasantly fuzzy. On the other hand, another picture might be sharp and crisp although lines that are fairly well separated may appear to merge together indistinguishably."

"Spread Function" Factor

According to Perrin, any picture can be regarded as an assemblage of points and edges; and even an edge can be regarded as an assemblage of points of different brightness. Points of different brightness, he continued, are therefore the *building blocks* of which any picture is made. The image of a point is always a disk or blob of light whose shape and size depends upon the quality of lens or films. This has been given the name, "spread function" by the mathematicians, he said.

"If the spread function is uniform over its area" but has sharp edges, the picture is sharp but will not reproduce fine lines well. If the spread function has a very bright center surrounded by a hazy area, it will make a picture in which fine lines can be seen with the aid of a microscope, but which is blurred when viewed in the ordinary way."

Perrin explained that when a lens and a film are to be combined, as in a camera, it is difficult to predict the quality of the picture from a knowledge of the spread function of the lens and the film alone; therefore, it is customary to describe spread functions in a different kind of language.

"If the quality of a phonograph is to be determined," he said, "a record having a series of pure waves of increasing frequency or pitch is played and the loudness of the sound from the loudspeaker is measured at each pitch. The same thing can be done for lens or a film except that the 'record' is a photographic negative having a 'wave' of varying blackness and the quality is

measured by finding how clearly the successively finer lines are reproduced. Such a measurement can be made in the laboratory or it can be computed if the spread function is known.

"Sine—Wave" Response

"This feature of lenses and films," Perrin said, "is known as 'sine-wave response' and is now used by laboratories all over the world." He explained that the sine-wave response predicts a curious effect in which a lens sometimes shows a series of bright lines where dark lines should be and dark lines where bright lines should be. Its usefulness in improving the quality of pictures the author showed by a study of a printer used for making motion pictures. "Improvements in the sharpness of pictures resulting from such investigations," he said, "are responsible for the widespread adoption of the modern small cameras."

The Artless Projectionist

Do not hesitate to let the screen cool off from the friction of the picture passing over it. The audience appreciates these little intermissions.

Shoot the picture about 15 feet past the screen, so they will be sure to reach for it. People just love a fuzzy picture, you know.

Don't hesitate to punch your own cue marks. The resulting bright flashes of light help to brighten up the most serious of tear-jerkers.

After threading in your own new reel, do not adjust the frame until the characters have walked around on their heads for a few minutes. This stunt is uproariously funny and shows the audience how mean you really could be.

In case of fire, run like hell out of the booth for the Fire Department. Be positive you check the oil at least once a year to avoid binding the mechanism.

Always cooperate with and love the manager, especially on payday. The poor man has enough trouble with the cashier. Keep the room door locked. Who knows when someone of importance might walk in? It pays to be prepared.

JAMES COTTER
IA Local 357, Kitchener, Oct., Canada

Ashcraft Direct-Contact Projectionist Policy

Pursuing its policy of constantly seeking and maintaining its close relationship with the projectionist through direct contact, C. S. Ashcraft Mfg. Co. was host on October 27 to the Projectionists' Square Club, a Masonic organization in the Greater New York area.

As an aside, the gathering gave "the back of its hand" to the oft-heard statement that projectionists are not particularly interested in the technical niceties of their craft, since a majority of the men came direct from a midnight meeting of Local 306, which lasted four-plus hours, to the Ashcraft plant.

Fine Technical Session

The Ashcraft organization was hard pressed to satiate the thirst of the visitors for technical information, since they placed themselves squarely (no pun intended) on the spot by holding the session in a representative screening room. It would be less than fair not to mention that the typical Ashcraft hospitality in the form of heaps of food and ample beverages was provided.

OBITUARIES

FRANK TIERNAN, SR., longtime member of Detroit projectionist Local 199, died recently after an extended illness. His age was 74. His last theatre stint was at the Woods Theatre in Grosse Point, prior to which he served at the Hollywood and Ramona Theatres in Detroit. Surviving are his wife and a son, Frank, Jr., also a projectionist and member of the Local.

• • •

JAMES A. McDONALD, veteran member of Local 228, Toledo, Ohio, died of a heart attack recently. He was 67 years of age. Previous to his retirement several years ago he was employed at Loew's Valentine Theatre for many years.

BOOK REVIEW

BASIC ELECTRONICS, by *Van Valdenburgh, Nooger & Neville, Inc.* Published by John F. Rider, Publishers, 116 West 14th St., N. Y. City. 136 pages, available in either a paper cover ($2.90) or cloth binding ($3.60). Profusely illustrated.

THIS IS a book we definitely like because it presents graphically the basic data we want. It is a companion volume to the present five-volume course on basic electronics. It is intended to enable individuals, schools, and industrial personnel upgrading programs to expand into the areas of sem-conductors, transistors and frequency modulation.

The format is the same as the existing very popular five-volume course. It uses the "picture" approach in teaching these vital modern subjects. The treatment accorded transistors and semi-conductors in the first half of the book is detailed and very lucid. One idea is presented on a page with each page having its related, specially conceived illustrated to suit the basic presentation of the idea.

Lucid Explanatory Data

The explanation of semi-conductors and transistors begins with the details of their construction, followed by a very clear discussion of the theory underlying their operation. All important aspects necessary for a basic understanding of junction types — p-n-p — n-p-n-voltage gain, current amplification, power gain, etc., are covered. Then, a wide variety of applications up to and including all of the circuits in the superheterodyne receiver are explained.

The second half of the book is devoted to the fundamentals of frequency modulation. Beginning with the explanation of what frequency modulation is, the book progresses to the organization of the F. M. transmitter, with explanations of the function and operation of each major section. The major circuit sections of F. M. receivers get equally good attention—each being schematicized and explained separately. Eventually, the sections are combined into a complete F. M. tuner. —J. J. F.

VICOM'S New Headquarters

Fred E. Aufhauser, formerly president of Projection Optics Co., and now president of a personal enterprise, VICOM, INC., announces the opening of his office at 800 Linden Avenue, Rochester, N. Y. VICOM, INC. will specialize in the field of motion picture equipment, magnetic film recording systems, audio-visual systems and optical projection systems as manufacturers, distributors and consultants.

CAUSE OF FOCUS DRIFT

(*Continued from page 9*)

the blisteringly hot gate of a front-shutter mechanism.

Focus drift is completely explained by this behavior of film. The projector gate is relatively cool when a projector is first started up, and the buckling of the film is then at a minimum. In a few minutes, however, the increasing temperature of both the gate trough and the metal runners heats the film *before it gets to the aperture.* It thus reaches the aperture in a heat-softened, pliable state. Buckling then becomes more pronounced; and when the depth of focus of the lens has been exceeded, the picture blurs on the screen.

Owing to the fact that the film has moved toward the lamp, the lens must also be moved in toward the lamp to restore the focus. *But the size of the picture on the screen remains unchanged,* a fact which proves that the focal length of the lens has not changed.

Humidity Range Important

This is not the whole story, for the conditions of previous storage or use greatly influence the behavior of a print upon projection. Storage under excessively humid atmospheric conditions, for example, may cause wavy "film flute" or incurable curliness.

The curl induced by winding film in tight rolls emulsion-side out immediately after processing aggravates focus drift. Even the smaller convolutions of normally treated film near the hub of a reel undoubtedly contribute to the tendency of the film to drift out of focus as the end of a reel approaches. The tight winding of fresh film in small rolls emulsion-side-in results in film flute and buckling during projection, especially if the film has been removed from a humid to a warm, dry atmosphere without rewinding to permit a more uniform release of moisture from the gelatin emulsion.

The cure for focus drift obviously involves intelligent handling of film and the use of projector gates which

---

Modern methods for recording the path of a bullet or the explosion of a dynamite cap in successive exposures on a *single* piece of film were outlined at the recent meeting of the Society of Photographic Scientists and Engineers. In photographing a bullet in flight, the bullet triggers an electronic circuit when it passes a certain point in its path. The circuit pulses a flash unit, perhaps once every 1/100,000 of a second, as the bullet passes the camera lens.

Each flash gives a *separate* picture of the speeding bullet on a single piece of film. By correct focusing and subject lighting, the shock waves produced by the bullet can also be photographed.

* * *

Public-address-system "howls" caused by amplifiers heating up or the speaker changing position, may be minimized by new electronic method developed by Bell Telephone Labs. By automatically compensating for variations in amplification with a frequency-shift modulator, unit makes possible a two-fold increase in loudness of p.a. system without accompanying instability.

are effectively cooled by running water. Heat filters or "cold" mirrors are also indispensable because they reduce the overall temperature of the aperture and mechanism.

Freshly processed rolls of film should be wound on cores of large diameter or large-hubbed reels, not on the little 1¾-inch hub, 1000-ft. reels which are used by many laboratories because millions of them have been left over from silent-picture days. The change of focus sometimes observed at the "midreel splice" in 2000-ft. rolls is caused by winding the two 1000-ft. sections on small-hubbed reels immediately after processing for shipment to the exchanges, where the prints are assembled on large reels for the theatres.

Possible Restorative Move

Storage of curly or fluted film in a humid atmosphere for several days sometimes succeeds in "revitalizing" the gelatin emulsion sufficiently to subdue the deformations which long-continued stresses have "set" in the pliable acetate film base. Nitrate base underwent similar stubborn deformations, although not to the extent that acetate base does. However, deformed nitrate base could never be "straightened out" once it had become deformed—it quickly became shrunken, rigid, and brittle. Modern acetate film is much more amenable to physical restoration unless it has been subjected to too much heat a bit too often.

The writer's comparisons of the properties of triacetate and nitrate film base materials could continue for quite a while, inasmuch as he possesses thousands of feet of nitrate film in an excellent state of preservation. Continued comparisons serve to point up the fact that while nitrate film gave better and more consistent projection results when new, it deteriorates under normal conditions of use so rapidly that triacetate film soon outstrips it in general superiority.

"Cold Projector" the Answer

The pity is that, by the time acetate film gives positive evidence of its permanence, the subject matter of the prints has been seen by the moviegoing public, and no one but the purveyors of late-late TV shows is interested. Seriously, it is a pity that the memorable feature-film productions of yesteryear could not have been photographed on the triacetate stock which is a commonplace today. Some of the outstanding silent films, imperfectly preserved only on nitrate "dupes" and lavender prints, are rotting in the vaults. Nitrate film decomposes spontaneously after years of storage under adverse atmospheric conditions and without frequent rewinding to expose the stock to the oxygen of the air. Acetate stock seems to be permanent.

Even the best methods of treating, handling, and storing film go for nothing, of course, if the prints are subsequently subjected to the terrific punishment of high-amperage projection with mechanisms which lack water-cooled gates. Dichroic heat filters or mirrors should *always* be used when arc current exceeds 75 amperes, but there is no substitute for a water-cooled "cold projector" to eliminate the nuisance of focus drift.

Let us remember that a *consistently sharp focus* is the hallmark of quality projection.

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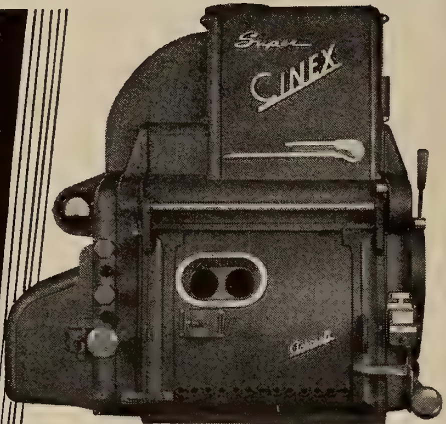

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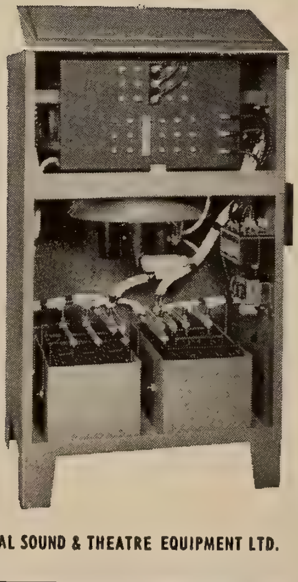

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Monthly Chat

Random Thoughts at Year's End

REVIEWING the happenstances in the projection field during the past year, one is assailed by a diversity of thoughts easily assembled but difficult to disassemble. Offhand, one would be tempted to red-check the upsurge of 35/70-mm projector installations as the outstanding development, but caution dictates that IP iterate its view that such equipment packages are for the favored few and, except for drive-in situations which have an insatiable appetite for more and still more screen light, pose a positive threat to the survival of the smaller subsequent-run theatres.

Why? Well, in the first place how many smaller theatres have $40,000-plus to invest in such equipment? How many 70-mm pictures will be available during the next two years? And how about the favored few grabbing off all the "BIG" attractions for long, long runs and thus extending the availability time for the smaller fellow whose tongue is already hanging out for product.

We're interested in keeping *all* existing theatres in operation for the simple reason that we like to keep our people on a steady work diet.

Speaking of drive-ins, whatever happened to the *announced* ambitious project of two major studios—Columbia and M-G-M—to provide special "light" prints for these spots? Both studios were queried and, while confirming the fact that they had "positive" ideas along this line, they stated that the method employed for producing such prints was "a secret."

We'll state flatly that the process of making a "light" print is as much a secret to us as the act of lighting a cigarette. Know what they're afraid of? Just this:

Discussing the matter with various lab men and cameramen who opined that any "light" print would be one which was as light as possible with "acceptable" contrast. Such a print would show acceptably on low-level screens but would washout on brighter surfaces. The cameramen stated, however, that a much better print could be made for drive-ins if they could light properly for it during photography. So why not?

You'll never believe this, but the fact is that the producers won't let them come up with a negative of this sort because it does not have "mood"! Moreover, special prints get in the hair of the exchange people in terms of getting the right print to the right theatre.

The Sunrise Casts Shadows Before

PORTENT: Automation in terms of motion picture projection in theatres has made giant strides in Europe during the past year. That such a development won't be introduced in America within the next few years is a bad wager. IP has recounted this advance in several articles intended to serve as an "alert."

These Fellows Go For Keeps

WHILE thinking of the old country, we're reminded of the *basic* requirements for a projectionist license in many European countries. As follows: a technical-school type of examination in electronic theory and the repair of defective amplifiers and power-supply units. A knowledge of algebra, trigonometry logarithms and plane geometry *and* a familiarity with basic physics.

Happy holidays.—JAMES J. FINN.

INTERNATIONAL PROJECTIONIST

extends to all its friends

Season's Greetings

Volume 34 DECEMBER 1959 Number 12

By ROBERT A. MITCHELL

Acoustics, Speakers and Volume Control

Motion picture sound and "live" reproduction differ radically in terms of requisite auditorium characteristics. Posed herein is the question whether the present loudspeaker setup for the former is really efficient. Volume control by the projectionist alone is rated impossible from the booth.

THE QUALITY of the sound reproduction produced by a theatre sound system and the acoustics of the auditorium are interdependent. The best sound system cannot overcome the handicap of bad acoustics, even though minor acoustic pecularities of an auditorium can be compensated by frequency-response adjustments and loudspeaker placement. Conversely, excellent acoustic characteristics cannot mask distortion in reproduced sound, silence system noise, or extend a deficient frequency range.

What is meant by the term "good acoustics"? The type of auditorium which the projectionist considers excellent for motion-picture sound is too "dead" for the concert artist. Musicians and singers insist upon acoustic "liveness" as a desideratum, and praise the acoustic properties of concert halls and opera houses in which the reproduction of "canned sound" would be utterly impossible. Many of the best theatres originally built for stage shows, musical performances, or silent pictures required considerable acoustic refurbishing before they could be used for sound motion pictures.

The reason for this difference in acoustic requirements is easy to understand. Live acoustic conditions actually amplify sounds by adding innumerable reflections (echoes) to the direct source of the sound. The singer or instrumental soloist who would sound very weak in a well-designed cinema auditorium is able to "project" even to the rear rows of the balcony in the concert hall.

Reverberation, Intelligibility

Moreover, the slight delay in the sounds reflected from hard-surfaced walls and ceilings prolong natural tones, increase the relative intensity of the bass frequencies and thus add to the natural richness of voices and instruments. The intelligibility of speech is not impaired unless the hall is so large that the reverberations are too long delayed.

There are cathedrals in Europe so large and cavernous that the tones of the organ pipes require several seconds to die away. Echoes rebound from wall to wall for such a long time that the words of the priest are an unintelligible rumble. Such a building is an extreme example of acoustic liveness. The well-designed cinema auditorium or recording studio stands at the other end of the scale as an example of acoustic deadness.

A movie-theatre auditorium should be as dead as possible, not only to preserve the intelligibility of speech, but also to permit actors in closeups to sound as if they really were only a few feet away. A cathedral scene should sound extremely reverberant; but the "liveness" is recorded on the soundtrack. So also with the echoes heard in scenes that call for echoes: they originate, not in the theatre auditorium, but on the set where the scene is shot.

Many years ago the writer worked as a projectionist in a concert hall where films were shown on certain days of the week. The auditorium was

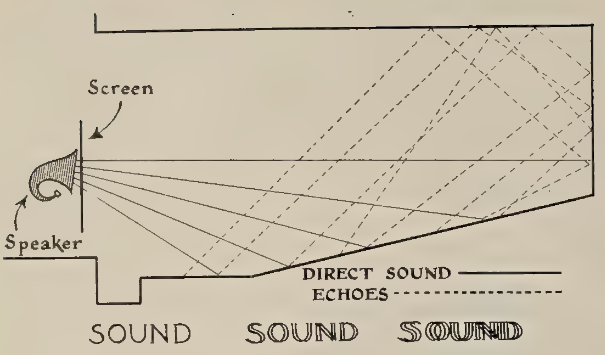


FIG. 1. The effect of echoes in an auditorium is called *reverberation*. Too much reflected sound in a motion-picture auditorium decreases intelligibility toward the rear of the hall because the multitudinous echoes reach the ears of the listeners later than the direct sound from the stage speakers. (Diagram suggested by *Philips Technical Review*, 11, 20: p. 318.)

acoustically perfect for concerts and opera, and had, in fact, been highly praised by many of the brightest luminaries in the world of music. The rear wall of the stage was of wood panelling, and concave to reflect and concentrate the voices and instrumental music of the artists. The plate-glass panels covering the walls of the auditorium introduced additional reverberation, insuring an even distribution of sound volume throughout. The use of electronic sound reinforcement was unthinkable and, of course, unnecessary.

Movie Sound Required Drapes

It requires little imagination to realize how very poor the movie sound was in this "acoustically superb" auditorium. Scarcely 3 watts of sound power were necessary, but the reproduction was a harsh, reverberant roar. It was necessary to cover the rear wall with heavy felt cloth and to drape the glass panels with velour. This done, the sound reproduction from film and records was passably good; and, as was expected, the sound power had to be increased to about 10 watts maximum.

Needless to say, the concert artists would not tolerate any acoustic treatment which made their voices and instruments sound weak and thin, so the drapes had to be completely removed before they would consent to perform!

Any good textbook of acoustic engineering supplies a wealth of data anent the designing of auditoriums for maximum deadness. Formulas are given for reverberation times and the sound-absorbing properties of the various materials used in construction, decoration, and the acoustic treatment of existing halls.

Most of this information is of little practical value to projectionists for the simple reason that few members of our craft are ever called upon to build theatres or design auditoriums. Our job is to operate the movie projectors as well as possible; and we try to minimize the unpleasant effects of excessive reverberation by keeping sound volume no louder than is necessary for satisfactory hearing.

On the whole, however, most of the indoor motion-picture theatres in use today are acoustically very satisfactory—that is, sufficiently dead through correct design or the judicious use of sound-absorbing materials to eliminate reverberation, "wall-slap" echoes, and other effects which interfere with the sound directly radiated by the stage speakers.

Much Unnatural Reproduction

Despite generally good acoustic conditions and the use of modern, well-designed sound systems in many of the larger theatres, the sound reproduction is not entirely natural. It is rather disturbing to hear poor sound in theatres which have been specially outfitted with the latest equipment for highly touted "showcase" exhibitions. Some of these theatre sound systems employ dozens of the largest, most powerful speaker assemblies and complicated floor-to-ceiling amplifier racks, and yet the reproduction obtained from the expensive paraphernalia is noticeably inferior to that provided by home "hi-fi" sets costing only a hundredth as much. Why?

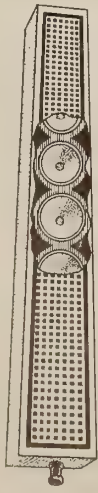


FIG 2. A "sound column" composed of a vertical row of speakers operated in phase. This arrangement concentrates the sound over a wide horizontal angle. Two such columns, one at each side of the screen, has advantages which are discussed in the text.

Correct amplifier design is now well understood; and frequency-response, intermodulation, resonance, and dynamic-range tests support the belief that most modern amplifiers, large and small, perform admirably. It is only when we attempt to convert a powerful output signal into sound by means of an adequately large speaker (or a set of three large speakers for stereophonic reproduction) that a disturbingly unnatural quality creeps into the sound.

Large Speakers the Answer?

Aside from the relatively minor matter of a correct choice of crossover frequencies for "woofer-tweeter" speaker combinations, the trouble appears to reside in the *size* of the speakers. Large sound-system speakers are often as well designed and even better constructed than the smaller speakers in home radio sets and hi-fi phonographs; but whereas the latter involve no unusual inertias and resonances, the moving cone diaphragms of the former cannot handle sound waves ranging from 1 inch (13,000 cycles) to 40 feet (30 cycles) in length without the intrusion of *secondary* effects.

Common Troublesome Effect

One of these troublesome effects is the generation of resonance in the heavy cones of powerful low-frequency dynamic speakers by high-frequency transients. This defect is noticeable during the reproduction of spoken words ending in such consonants as *t*, *d*, *k*, *b*, and *p*.

The words may be spoken by a female voice, and accordingly reproduced mainly by the high-frequency horn; but the final consonant acts as a low-frequency pulse which passes into the low-frequency unit through the crossover network. The resulting resonance of the heavy cone adds a "slap" to the sound which is very difficult to describe.

Other sound defects of large speaker units have been traced to interference patterns between high- and low-frequency units and to a "peaky" response of the high-frequency horns. Most of the multicellular "tweeters" examined to date have an undesirable

(*Continued on page* 20)


What's the best way to
SKIN A CALICO CAT?
OR—re-phrasing the question—what is the best way to release a picture in 16mm color? That's the problem!
Actually, there are 9 methods of skinning this particular cat; each has a different cost, each has different technical pros and cons. All assure effective results. Advising the industry in situations such as this is a daily service of the Eastman Technical Service for Motion Picture Film.
Offices located at strategic points. Inquiries are invited.
Motion Picture Film Department, EASTMAN KODAK COMPANY, Rochester 4, N.Y.
East Coast Division
342 Madison Avenue
New York 17, N.Y.
Midwest Division
130 East Randolph Drive
Chicago 1, Illinois
West Coast Division
6706 Santa Monica Blvd.
Hollywood 38, California

Serving Art Through Technique

By JEAN VIVE

Professor, Ecole Technique Photo-Cinema, Paris

Through the courtesy of the editors of "British Kinematography," world-famous journal of the cinematic arts and sciences, IP is privileged to present the appended excerpts from an address given before the Society by an acknowledged authority on the art of motion pictures. Of especial interest are his remarks anent the bastardization of the anamorphic process and his insistence upon pre-shooting appreciation of a proper gamma level.

THE growth of cinematography in France, even in its earliest origins, is notable in that development in technique and art expression have been intimately linked. One of the most illustrious personages in the history of cinematograph techinques illustrates a striking example of this connection: I think of the man who created the very first show on animated projections—Emile Reynaud.

Having been led to tackle the problem of the reconstruction of movement in order to illustrate a public lecture, Reynaud thought out a clever device for optical compensation by means of mirors fixed on a rotating wheel and presented it on June 4, 1880—this device being the Praxinoscope. This met with great success as a toy, and Reynaud began a small hand-made production of it, showing real talent as a designer in making the color drawings on the strips to be placed in the drum of his Praxinoscope.

First Public Moving Projections

This double gift, being a technician as well as an artist, led Reynaud to produce his "Theatre Optique" in the year 1888; he replaced the circular strips of images by long transparent ones which, by means of eyelets and pins, pulled the mirrored-wheel, thus enabling the first public show of moving projections to be given. The Theatre Optique opened in 1892 in the Musee Grevin on the Grands Boulevards in Paris.

After that, it was a premanent worry for Reynaud to create these colored strips made of 500 to 700 drawings, the charm of which still is popular. He spent his Sundays and holidays studying the movement of human beings and animals. All the year through, except when he was giving shows, he drew, painted and assembled the frames for his "Pantomomes Lumineuses."

Fateful Evening—Dec. 28, 1895

Forerunner of the motion picture show, Reynaud was also the first and talented maker of the first animated cartoons. We find this happy union of technique and art again at the birthplace of cinematography, after the researches by Marey, Dickson, Edison and Friese-Greene had led the way to the photographic recording of motion.

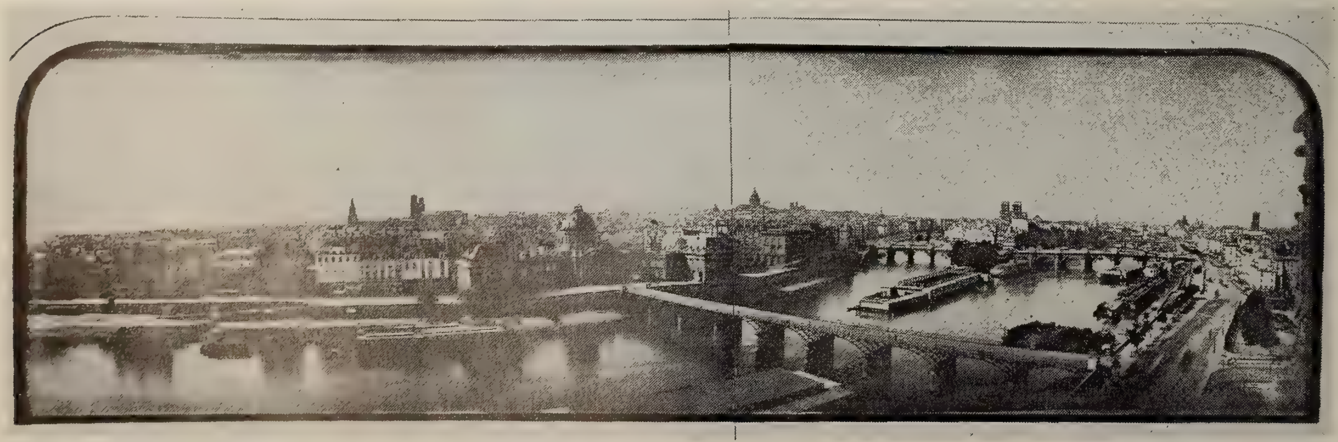
During that famous night of December 28, 1895, in the Indian Room of the Grand Cafe, the brothers Lumiere, inventors of the Cinematographe (represented by their father), and G. Melies, the Director of the Robert Houdin Theatre, came together. The Lumieres had found a perfect mechanism for registering and projecting images from perforated films; and Melies was to create Cinematography.

Let him speak for himself through his *Memoirs*: "Fascinated by the first animated photographs, Melies wanted to buy or to rent a projector for his theatre. Lumiere refused to sell, wanting to dedicate his invention to science alone. Melies, full of resentment, seeing in it an instrument providing him with the proper means for a splendid show, was racking his brains, making plans. . . . He then heard that an English optician, Robert W. Paul, was putting on the market a projector using for the projection the black background films from Edison's Kinetoscope."

What happened then is well known: Melies made his own camera along the lines of Paul's projector he had bought in London, and showed his first films in the Robert Houdin Theatre. In December, 1896, he built in Montreuil-sous-Bois the first studio for Cinematography, with stage and machinery. In 1897 he established a proper cine show.

Standardization of Perforations

Melies was the man who set up the original Chambre Syndicale des Editeurs Cinematographiques (Producers' Association) and presided at the First International Congress of Cinematography in 1909. It was at this Congress that the standardization of the perforation was agreed. Other persons attending were: Rogers, Ch. Pathe, Eastman, Melies, L. Gaumont, Urban, Gifford, Smith, and Austin. Urban and Smith were the British inventors of the Kinemacolor two-color process; I remember seeing in Paris the famous "Delhi Durbar," photo-



George Eastman House Collection

Panorama of Paris, probably taken from the roof of the Louvre. The image is reversed. Right-hand half of a daguerreotype, 5 x 17½ inches, by Frederick von Martens, 1846, taken with a camera of his own invention.

graphed in the Kinemacolor process.

It is in the field of presentation that the most significant examples of development are found: the techniques in picture-taking and sound-recording have shown the most striking progress. As proof, one can mention the new equipment designed by Ets. Debrie (in 35-mm), the Societe Tolana (in 16-mm), for the remote control of the registered image through a video channel while enabling a director of photography to follow perfectly on the screen of a console receiver the moves of the camera, the changes in focal lengths, and the framing of an image. He can even supervise the contrast of lighting during checking the lights—the basic key of the whole presentation.

The desire to achieve perfect pictures of women led us, before World War II. to the extensive use of small projectors, so as to make refined lighting effects. Later the fashion was for *dashes* of light. This spread to an extreme. We obtained the required effects by using various masks, cut out of cardboard and secured, generally, by means of clothes pegs.

Realism the Driving Force

It is a sign of the adaptability of the great French cameramen to adjust, as much as possible, the style of lighting to the *very nature* of the subject.

Hughes Laurent rebuilt a whole suburban street of Paris to be used by Rene Clair in his film "Sous les Toits de Paris" (1930), a setting which attracted attention through its poetical rendering. The haze effects were obtained by pieces of gauze; the passing of the local train was suggested by the smoke of a torch a man was carrying along the fence of the deserted ground.

Proper Gamma Vital Factor

Only after ascertaining the sensitometric characteristics of the emulsions and making arrangements with the laboratory technicians about the required gamma, can a director of photography decide about the brilliance and contrast he must give to the images. The higher the gamma, the higher will be the contrast, and *vice versa.* Bearing this principle in mind, the cameraman will give an exposure time either to reach the middle of the curve, for an average contrast, or to tend towards underexposure nearing the toe of the curve, if he is looking for greyish-blacks; or, on the contrary, aiming towards the shoulder of the curve if he wants pictures with less highlights.

For this kind of work it is very important to proceed with a constant gamma system, and not follow the old methods by making test strips with variable developing times, according to the estimation of the chief of the developing laboratory. With a constant gamma, there will be no more misinterpretations, and the person in charge of the lighting accepts resonsibility.

Some think that a certain lack of interest (or change of mood) in black-and-white photography is due to the introduction of color. This is not entirely wrong, because when shooting in color one generally tends towards using a more diffuse and less contrasty lighting, by which all "effects" are excluded.

Some have tried to go other ways, in particular by using colored lights. On the other hand, the great progress made in testing and printing permits very high contrasts to be made with certain monopak processes in which the rendering of the shadows is practically neutral, as with the Eastman-color film.

Projection Practice a Shambles

The rivalry between black-and-white and color, as well as the variety in the treatment of monopack (commonly called integral tripack) films, demand from our manufacturers and laboratory men great efforts in producing equipment and techniques.

The launching of the monopack film was one of the most important factors. We must not forget, however, that remarkable progress has recently been achieved in black-andwhite emulsions; the wonderful opportunities offered to us by the high speed emulsions (Kodak Tri-X and Geva (36), for shots of night life have opened the way for a new type of style in presentation.

With the actual projection in the theatre we reach the last link in this chain. Why is it that we have to deplore the damage caused by techniques labelled as "the latest known" with misleading excuses for a rejuvenation of the cinema?

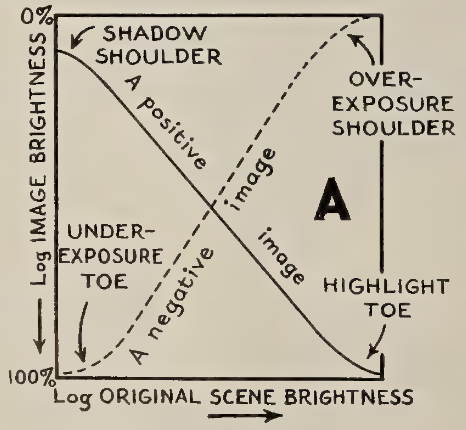
Rejuvenation? That kind of projection of mutilated images on screens, every day wider, through unsuitable equipment, with inadequate optics, on reflection screens with poor overal luminance distribution?

Rejuvenation? Those distortions and aberrations due to the panoramic process employing anamorphosis, the images of which are too wide and of insufficient sharpness, are making all artistic ambitions quite impossible to achieve.

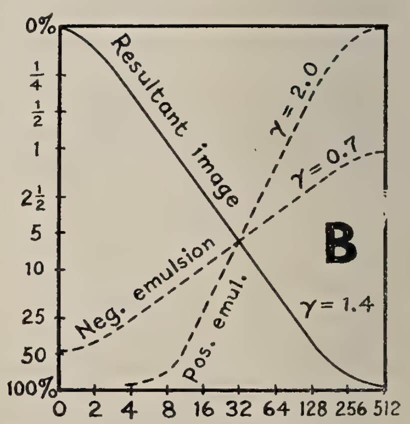
But there are technical innovations by which the quality of the image can be improved. I think of the use—for negatives, for instance—of a larger picture area, maybe the normal 35-mm film but running horizontally, or the 65- or 70-mm film, run vertically.

The technique of horizontal filming in France has given birth to an interesting equipment, with the advent of a prototype camera the Maxivision, manufactured by Debrie, which comprises an important new feature, a curved gate with V grooves, avoiding all possibility of

(*Continued on page* 19)



Positive-type image: gamma (γ) = 1.2



Negative-type image: gamma (γ) = 1.5

These "H & D" diagrams show how the contrast characteristics of developed film images, projected-picture images, and TV images are plotted. As shown in *A*, the negative-type images produced in non-reversal film emulsions are plotted so that the image brightness is greatest at the point of least exposure—the darkest areas of the original scene.

The positive-type images of prints and TV pictures, on the other hand, are plotted so that the brightest part of the image corresponds to the brightest part of the original scene. The two types of "gamma curves" thus slope in opposite directions.

Negative (camera) films usually have low contrast and gamma values; while the emulsions of positive films are more "contrasty" and thus exhibit steeper H & D gamma slopes. This may be seen in *B*, where these two emulsions are plotted in broken lines. The negative gamma of 0.7 and the positive gamma of 2.0 are customary in professional motion-picture work. Multiplied together, they result in an overall, or positive-image, gamma of 1.4, which is just a bit on the "contrasty" side. This is shown by the solid line.

Notes on Sound and Hearing

By DR. HARVEY FLETCHER

One of the highest honors bestowed by the Society of Motion Picture and Television Engineers is that of Honorary Membership. This has now come to Dr. Harvey Fletcher, formerly of Bell Telephone Labs., and now Dean of Brigham Young University, Salt Lake City, Utah. The citation reads: "A pioneer in modern psychoacoustics who has bridged the chasm between physics and psychology leaving such permanent spans as the relation between frequency, intensity, and loudness (the Fletcher-Munson curves), the subjective loudness scale, and concepts of masking."

To signalize this event, IP reproduces an excerpt from one of Dr. Fletcher's early and still authoritative contributions to the audio field (IP for January 1935, p. 15).

MUSICIANS employ three terms to describe different aspects of the sensation they experience when listening to musical tones. These are *pitch, loudness,* and *timbre,* although the term quality, or tone-color, is sometimes substituted for *timbre.* Most textbooks on physics have taught that these psychological characteristics are related in a simple way to three corresponding physical quantities: frequency, intensity, and overtone structure.

The relationship between pitch and frequency, and between loudness and intensity, has been thought to be one of direct correspondence: the pitch of each note corresponding to a definite frequency, and the loudness of each note to a definite intensity. The relationship between harmonic structure and timbre has had no such simple formulation, but at least the timbre has been thought to depend on overtone structure alone.

Interdependent Elements

Studies in these laboratories, however, have shown that no such simple relationships exist, but that each of the psychological quantities — although depending chiefly on the corresponding physical quantity — actually depends upon *all three.* That there has not been a strict one-to-one correspondence between loudness and intensity has been known for some time, but only recently has accurate quantitative data been obtained. Between pitch and frequency, on the other hand, it is generally thought that there is a strict one-to-one correspondence.

Frequency is the number of vibrations per second made by the sound source, such as a tuning fork or a violin string. Most musical tones, however, are composed of a series of frequencies which are multiples of the lowest, or fundamental. For such tones the frequency of the fundamental is considered as the frequency of the tone, while the number and magnitude of the harmonics produce the overtone structure that results in the perception of a definite *timbre.*

Intensity vs. Location

The intensity of the tone is the power-content of the air vibrations at the position where the listener hears the tone.

Among musicians, loudness is roughly gauged in seven steps running from *pp* (pianissimo) to *ff* (forte). Such a scale is entirely inadequate for scientific studies, both because the steps are too large and because there is no definitely established reference loudness.

To provide a more suitable measuring scale, it has been the practice for some time in Bell Laboratories to measure loudness in terms of the power intensity of a pure tone at a frequency of 1000 cycles per second. Because of the wide range of intensities to which the ear responds, it has been convenient to use a logarithmic scale of values.

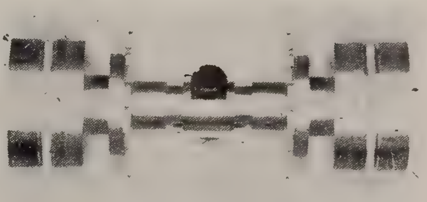
The use of such a scale is further justified because the minimum change in intensity that the ear can detect seems to follow more nearly a logarithmic than an arithmetic law.

Sound Intensity Factor

Although no quantitative measurements have been made upon the timbre of a musical tone, we know that it depends not only upon the overtone structure but also upon the intensity. If a violin tone, for example, is reproduced at a very much higher intensity than that at which it is usually heard, it will be very evident that the *timbre* is changed.

A scale for representing timbre is now being worked out, and it will be interesting to see if some quantitative measurements similar to those reported under loudness and pitch can be made to describe the quality aspects of the tone. It is sufficient to say here that there is no doubt but that the results will show that timbre is dependent not only upon the overtone structure but also upon the intensity and the pitch of the tone.

It is thus a safe conclusion that each of the three psychological characteristics of a tone is dependent upon all three of the physical characteristics, although the influence of one is predominant in each case.



Here is the Century Projector combination 35/70-mm intermittent sprocket. [ED.'S NOTE: Showing vital machine parts in halftone still is one of the most futile endeavors of man— one sees practically nothing. A nice sharp line-drawing would serve all of our purposes ever so much better—but manufacturers never seem to learn this lesson.]

Addendum to Foregoing

THAT UNEXPLORED AREA which Dr. Fletcher visualized in 1935 has been successfully charted by Dr. John G. Frayne, retired engineer and manager of Westrex Corp., Hollywood, Calif.

Dr. Frayne, a contributor to these columns, received at the recent meeting of the SMPTE the Samuel L. Warner Gold Medal Award which is given to an engineer who has made an outstanding contribution to inventions and methods most likely to have a beneficial effect upon the recording and reproduction of sound motion pictures. Dr. Frayne received the Award for his contribution for the development of a 70-mm stereo six-track magnetic film system and test films.

Comprehensive Research Work

Prior to his recent retirement from Westrex, he was engaged in basic engineering studies relating to sound recording on film, including sensitometry, densitometry, electro-optical transducers, noise-reduction systems, push-pull recording, application of stereophonic sound to motion picture films, phonograph records, and multi-channel magnetic recording on sprocket-type films. These studies resulted in 10 U. S. patents.

This is Dr. Frayne's third SMPTE Award. In 1940 he received the Society's Journal Award, and in 1947 he was awarded the SMPTE Progress Medal Award.

Canada's Pay-TV Scheme Is Deferred

Although the introduction of Telemeter pay-TV in a Toronto, Canada, suburb has been deferred until "early 1960," officials of the company, a Famous Players subsidiary, insist that "everything is coming along just fine." In fact, they say, a 200-home test will be held at Christmas, with 1000 installations slated to follow shortly thereafter.

It's becoming increasingly obvious that films, old or new, won't do the trick, since 60% of the ladies responding to the system's ads want to see the plays at the Crest, a legitimate theatre, right from the stage as played.

Two remote pickup trucks will be employed, and Videotape equipment is on order.

Mechau: Continuous Mirror Projector

By RICHARD D. BARTEL

Member, IA Local 162, San Francisco

IT WAS of special interest to me to note a couple of articles in IP about the Mechau non-intermittent projector inasmuch as I operated a pair of these mechanisms while with the U. S. Army in Europe. These machines have many interesting features from the projectionist's point of view.

The accompanying picture shows that my mechanisms were exactly the same type as shown in IP. The whole projector unit is in one piece and is mounted at a 45° angle. The machines always sat level, the projection angle being set by means of a mirror mounted at the top. The projector weighed more than 300 pounds, exclusive of lamps, bases or film magazines.

The main mechanism was a sealed unit, and the ones I operated had not been opened since sometime prior to 1939; when I left Europe in 1949 they still were running fine.

Uses Eight-Mirror Drum

The operating part of the Mechau consisted of a drum of eight mirrors that turned at three revolutions per second. This is truly a continuous projector because the picture projected at all times. As the mirrors went around first, one mirror projected light to the curved film gate (a couple of frames long) and at the same time another mirror was projecting the picture.

As the frames moved past the aperture the next mirror in sequence would be starting on the next frame in such a manner that one frame would dissolve into another, thus giving 100% light projection at all times. Naturally there was some loss of light in the mirror system, but I don't know the exact amount.

This type of action makes the Mechau the ideal projector for TV stations since there would be no problem of synchronism between the 24-frame speed of the projector and the 30-frame TV signal because the picture is being projected 100% of the time. It occurs to me that the light loss was fairly low because in pulling only 60 amperes we had a well-lighted 24-foot screen.

Novel Film Passage

The upper magazine was 18 inches and held 2000 feet of film on a split reel. It was mounted flat on its side. The center of the reel had a hub which enabled carrying the reel; extreme caution had to be exercised with these reels so as to not have 2000 feet of film on the floor.

From the upper magazine the film was pulled on a 32-tooth flanged type of sprocket with a fiber-type pad roller. Then by means of a large loop the film made a 90° bend and came into the gate on a safety roller. The latter was a nice feature because if the film broke the projector would be stopped, the light cut off and even the port shutters dropped (we had nitrate film at the time). It would also stop the projector automatically at the end of a reel.

Double Loop Tricky

After the film passes through the gate it goes over a 16-tooth sprocket and then makes a large loop again and another 90° bend to go over the soundhead. The latter is made of a drag gate that the film goes through and a 180° curved sound shoe where the soundtrack is scanned and then on to a 32-tooth holdback sprocket and into the lower magazine, which also lies on its side.

The great thing about the takeup was that the weight of reel on the clutch determined the degree of pull. It is much better than other types since the takeup reel is always in perfect alignment with the holdback sprocket.

The arclamp was very crude, pulling 60 amperes and using a Suprex type carbon trim. It had a clock-type feed system. The motor drive was adjustable in speed and we could run at 40 frames per minute or 16, as we wished.

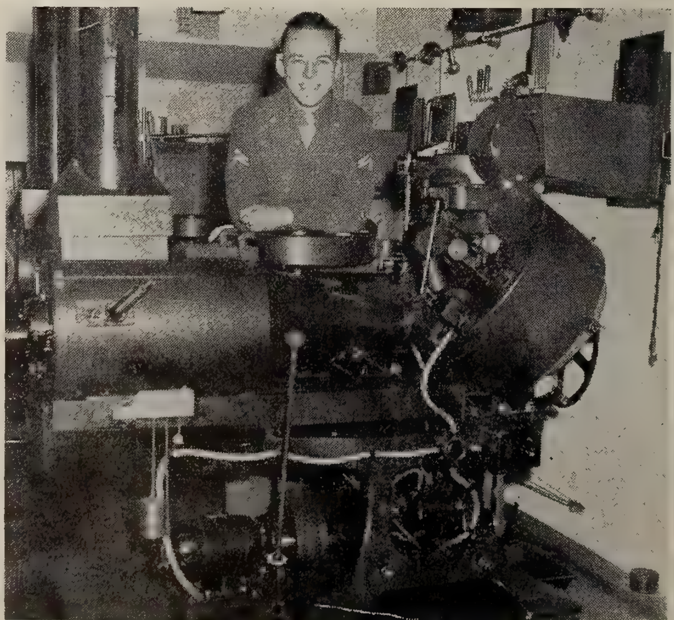
The machine was oiled by a pump and a reservoir at the top. The oil was collected on the bottom and pumped back to the reservoir at the top where it was filtered and then fed back over the moving parts. The only part of the machine requiring much care is the mirror setup which has to be cleaned regularly. We cleaned them twice a week by opening up the picture gate so we could reach the mirrors.

The picture projected by the Mechau was rock-steady and of course flickerless with no film wear at all. I have a 16-mm model of the Mechau type of operation which, incidentally, was contrived in 1912. Maybe if I can ever get it sold we may have a 16-mm model on the American market.

Driver Education Series

NET Film Service, Indiana University has available a driver education series for classroom instruction or general adult audiences. The new series of 29 films is based on the driver education program for the Cincinnati public schools conducted for two years through the facilities of WCET Cincinnati. It uses film inserts, magnet board models, dummy automobile controls and rear screen projection to illustrate driving techniques.

The series was produced with the counsel of an advisory committee of nine educators prominent in safety education appointed by the National Commission on Safety Education of the National Education Association. Each film runs 30 minutes in length and sells for $125. Preview and purchase information may be obtained by writing to the NET Film Service, Indiana University, Bloomington, Indiana.



The author shown alongside the Mechau continuous projector which he operated when stationed with the U. S. Army in Europe. The projector looks deceptively small, but it weighs more than 300 pounds.

AUDIO - VISUAL
EDUCATIONAL • INDUSTRIAL • COMMERCIAL

Tv and the Crisis in our Classrooms

A Progress Report by Radio Corporation of America

On the color tv screen, Chemistry Professor John F. Baxter put a few drops of a pale fluid into each of two small beakers of distilled water. He explained that the purpose of his experiment was to illustrate gaseous diffusion—a spontaneous process in which one gas is liberated in another. To one beaker, he added ammonia. The pale fluid turned pink. Slowly, the vaporizing ammonia was absorbed by the water in the other beaker, and its fluid also turned pink. Across the nation, an estimated 500,000 early-rising students of NBC's "Continental Classroom" noted the experiment in their workbooks.

A Revolutionary Development

In a TV studio in downtown New York, Professor Harvey Zorbaugh held up a scale model of an earth satellite, then moved over to a table containing a replica of a Shakespearean theatre, and finally to another table holding a sleek cutaway model of an atomic submarine. As he described these typical "props" of the TV teacher, a dozen graduate students at New York University's RCA-sponsored Center for Instructional Television listened intently and jotted down notes.

The early-rising viewers before their home TV screens and the graduate students at N. Y. U. are participants in two of the latest exciting experiments in educational TV, the most far-reaching development on the classroom scene today.

Overall Picture Today

Scarcely six years old, educational TV has burgeoned almost as rapidly as its commercial counterpart. Well over a million elementary and secondary school pupils and college students are now getting at least part of their formal instruction via TV. Practically every course in the curriculum—from Arithmetic to Zoology and from Milton to Marriage—is being taught somewhere by TV. Educators are hailing TV as an indispensable tool that can bring about a massive upgrading of our educational standards and help overcome the present critical shortages of teachers and classrooms.

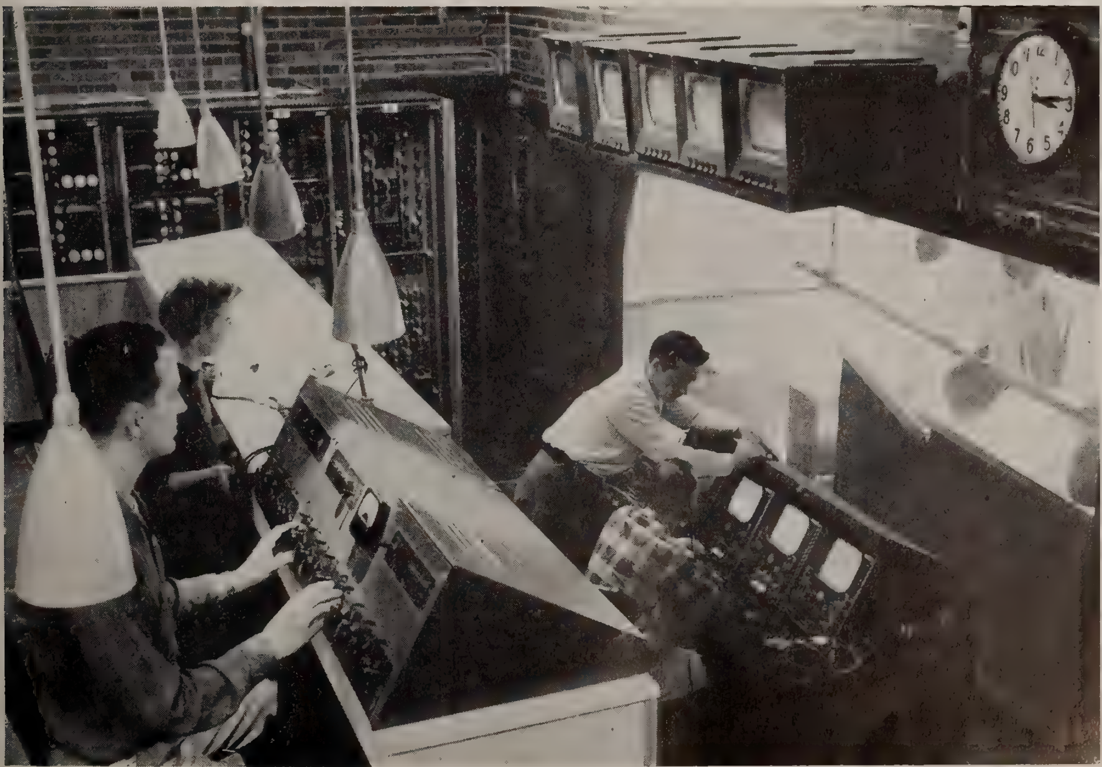
A comprehensive, nation-wide survey just completed by RCA shows sharply increasing activity in all forms of educational TV. This is the picture in brief: There are 44 non-commercial educational stations in operation and a dozen more are under construction. There are some 300 closed-circuit installations in schools and colleges throughout the country. Closed-circuit TV is being used for instruction and training at 21 military bases.

The commercial stations and networks are offering an ever-increasing fare of educational and cultural programs, many of them for college credit.

Educational TV stations—specially licensed by the FCC, and supported by state and local governments, business, civic and professional groups, and foundations—are now operating in every section of the United States.

Huge Potential Audience

They have a potential listening audience of 70,000,000—more than 50% larger than the nation's total public and



RCA-equipped television teaching center at the State University of Iowa uses three studio cameras plus audio and video control equipment. Students rotate assignments in the control room (left) which overlooks studio area. To meet problem of rising enrollment the University has built one of the largest educational TV centers in USA.

private school enrollment. Surveys show that around 15,000,000 persons watch ETV stations on a fairly regular basis. They take the courses seriously too. In Chicago, for instance, 6500 viewers sent in a half dollar each for study guides in a beginner's course in German. In Denver, 5600 paid one dollar each for Spanish language guides.

The ETV stations broadcast more than 1000 hours a week of informative and cultural programs for the home and school. Some of them are on the air from early morning until late at night. Their programming includes story-telling, music and drawing for pre-school youngsters, courses in the basic subjects for broadcast into classrooms, and adult-education programs.

The steady growth of ETV stations is paralleled by the increase in closed-circuit hook-ups in which lessons are piped by coaxial cable from one classroom or studio to a group of classrooms or several schools. The largest closed-circuit TV experiment is being conducted at Hagerstown, Maryland. There 16,000 students, in 36 schools scattered over an area of 462 square miles, are getting part of their instruction via TV.

On the college level, the most widely known project is at Penn State University which has a campus-wide network of six separate closed-circuit systems.

Color Closed-Circuit TV

Already, a few closed-circuit installations are using color TV. Largest of these is at the Army's Walter Reed Medical Center in Washington, which uses a three-channel system, each with its own studio and control center, to pipe lectures and demonstrations not only to the various buildings in the huge center but to other points in the Washington area and even to medical conferences in New York. Ceiling-mounted cameras in an operating room provide more comprehensive views for students than they could get in an operating amphitheatre.

Because of their need for getting results quickly, the Armed Forces have been in the forefront in using TV. The world's largest military closed-circuit educational TV system is now in operation at the U.S. Army Signal School at Fort Monmouth, New Jersey. The seven-channel system uses TV cameras for both live and film programming. A total of 468 receivers brings instruction courses and other training material to a student body of 6,000 men. Thirty-five TV receivers are situated in the base hospital so patients can keep pace with their classmates while recovering from illness.

FAMILY GROUP: Mrs. Mary and Clarence Ashcraft and their son Bud at the recent gathering of the Projectionists' Square Club (NYC) Masonic group at the Ashcraft plant.

Accredited by 300 Colleges

An increasing number of educational and cultural programs are being carried by commercial television stations and networks. An outstanding example is "Continental Classroom," now in its second year on NBC in the 6-to-7 a.m. time slot. This first college-level instruction ever offered on a national network is accredited by more than 300 colleges and universities from coast to coast. Its 500,000 viewers make it the world's largest classroom.

Designed primarily to help high school science teachers, the courses in Atomic Age Physics and Modern Chemistry have made early-risers out of housewives and G.I.'s, priests and prisoners, engineers and the physically handicapped.

[TO BE CONTINUED]

Global Entertainment Body Sought by U.S. Group

Richard F. Walsh, president of the IATSE, has been in Brussels, Belgium, where he served as one of the AF of L delegates to the International Confederation of Free Trade Union Congress. A special conference at the Congress mapped plans for the organization of an International Entertainment Workers Federation.

Also participating in the gathering was Herman Kenin, president of the American Federation of Musicians and representatives of the various actors' groups in the U. S. Delegates from various other parts of the world included Sir Tom O'Brien, secretary of the British National Association of Theatrical and Kine Employees.

Kenin, a red-hot exponent of the principle of residual payments, observed: "The principle of continuing pay for continuing services is, of course, a fundamental of honest dealing and one which deserves world-wide protection in line with our growing domestic application of residuals and reuse payments."

Goldberg 4600-Foot Reel

New 22-inch-diameter, cast aluminum reels for 70-mm projectors are available from Goldberg Bros. of Denver, Colo. The reel has a 7-inch hub, ½-inch core, and four holes located on the side of the flange for pin driving. It holds approximately 4,600 feet of film.

The same size reel is also made in 35-mm with a 70-mm adapter attached to the reel. Still another cast aluminum reel for 35-mm with a 70-mm adapter is 16⅞ inches in diameter with a 5-inch hub.

35/70 Installations in U.S. and Canada

THE increasing number of installations of 35/70—mm projectors has aroused keen interest among projectionists who, after all, will have the responsibility for their proper functioning. The printed word may be useful in exciting interest in a given unit of equipment but of course it can't compare in terms of practicality with viewing the unit under actual operating conditions.

It is manifestly impossible for the manufacturers to conduct seminars on these projectors in every state in the United States and every province of Canada. But with the growing list of installations it is a comparatively simple matter for projectionists in all areas to witness the projectors in operation.

Several months ago IP promised to print the list of such installations so that projectionists may see these projectors in operation in their own locale. The first such list is appended.

Norelco DP 35/70

[North American Philips Co., Inc., 100 East 42nd St., New York 17, N.Y.]

NOTE: *The great majority of Norelco installations are listed on the back cover of this issue. Additionally:*

CITY	THEATRE
Birmingham, Ala.	Ritz
Culver City, Calif.	M-G-M
Hollywood, Calif.	Screen Directors
Miami, Fla.	Florida
New Orleans, La.	Houck's Patio
St. Louis, Mo.	Esquire
Upper Montclair, N.J.	Bellevue
Rochester, N.Y.	Riviera
Cleveland, Ohio	Colony
Cleveland, Ohio	Palace
Oklahoma City, Okla.	New Cooper
Portland, Ore.	Hollywood
Philadelphia, Pa.	Stanley
Chattanooga, Tenn.	Rogers
Madison, Wisc.	Strand
Washington, D.C.	Warner

National Seventy

[National Theatre Supply Co., Inc., 92 Gold St., New York 38, N. Y.]

Norfolk, Va.	Menrose
Pittsburgh, Pa.	Fairground Drive-In
Utica, N.Y	Uptown
Memphis, Tenn.	Crosstown
Pontiac, Mich.	Miracle Mile Drive-In
Baltimore, Md.	Town
Fall River, Mass.	Center
Vancouver, B.C.	Capitol
Edmonton, Alta.	Paramount
Calgary, Alta.	Capitol
Winnipeg, Man.	Metropolitan
Toronto, Ont.	University
Montreal, Que.	Seville
Cincinnati, Ohio	Twin Drive-In

Victoria-X

[Cinematograph International, Inc., 341 West 41st St., New York 36, N.Y.]

Shore	Huntington, L. I., N. Y.
Grand	Terre Haute, Ind.
Lincoln	Miami Beach, Fla.
State	Wichita Falls, Texas
25th Street	Waco, Texas
Town & Country	Jacksonville, Fla.
Center	St. Petersburg, Fla.
Melba	Dallas, Texas
Preston Royal	Dallas, Texas

All three of the aforementioned projectors of course have many installations abroad, particularly in Europe.

New "Superchromat" Lens Formula by Kodak

A "superchromat" lens, the first ever to be corrected for all colors of visible light, is promised by an improved optical formula devised by Dr. Max Herzberger of Kodak Research Laboratories. A three-element lens, made with three glasses chosen from a graph based on the new formula, is corrected for light from the ultraviolet to the infrared, or from 365 to 1,010 millimicrons.

Current lenses represent a compromise, the scientist explained, since correction for two colors may cause chromatic aberration for the other colors in the spectrum. In a camera this would mean that images of differently colored objects photographed in the same position would fall in slightly different places on the film.

All-Color Registration

Previously, with special glasses called "short flints," it has been possible to correct some triple-element lenses for three colors only. These lenses are known as "apochromats." The use of fluorite in microscope lenses has been still more beneficial. But fluorite changes its refractive index with temperature and does not easily lend itself to long focal length lenses.

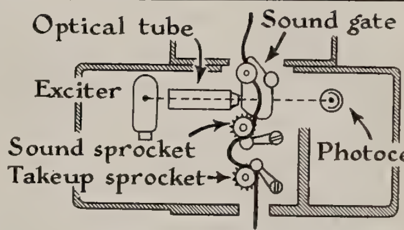
Dr. Herzberger discovered that a great number of glasses can be found which permit design of a unit of three lenses which he calls a "superchromat." With this type of lens, images of all colors are in perfect register.

Dr. Herzberger's new formula differs from usual dispersion formulae because it is *linear*. This makes calculation of values much easier for lens designers, and permits less involved use of machines such as computers in lens design problems, he said.

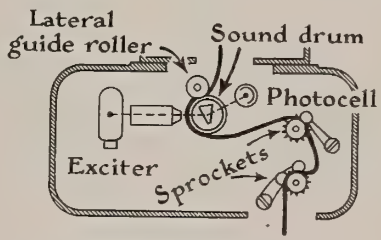
The Dispersion Formula

The dispersion formula depends upon four data for a given kind of glass. Given these constants, refractive indices for any wavelength of light can be computed. Two of these data, plotted against each other, give the curve from which the glasses for a "superchromat" are chosen. If optical characteristics of any three glasses fall in a straight line on this graph, they will form a "superchromat" when correctly combined in a lens.

A detailed report of Dr. Herzberger's work will appear soon in the scientific journal, *Optica Acta*.



OLD-STYLE SOUNDHEAD



MODERN SOUNDHEAD

The old-style soundhead employed a direct sprocket drive of the film through a "sound gate." This arrangement has five disadvantages which are eliminated by the new-style rotary-stabilizer type of reproducer which employs a revolving sound drum without a gate.

"Weather" in the Projection Room

By DR. FREDERICK J. KOLB, JR.

Research Laboratories, Eastman Kodak Company

THE "weather" in most projection rooms varies during the year from the very low humidity, desert-dry air of the cold winter months to the warm, tropical, humid air of mid-summer. These variations have important effects on the performance of motion-picture film (as well as projectionists) and some projection problems can be eased if a little control of this "weather" is provided.

Film Curl, Brittleness

When the cold winter air is warmed to room temperature without the addition of more moisture, the resulting low humidity and dry air instantly evaporates perspiration, dries and sometimes cracks the skin, makes fingernails brittle, and encourages the jumping of static sparks.

Under these same conditions motion-picture film becomes more curly, more subject to brittleness, and more likely to accumulate static electricity. Anyone who has had the chance to carry a short piece of film from a humid to a dry room can actually see the very rapid curl change. High curl film may become scratched by contacting recessed parts of the film path, will be difficult to hold and locate in splicers, etc., and when wound at low tension produces spoky rolls.

Its increased brittleness may show up as the film is cupped between the fingers during examination or as the perforations are forced over misfitting pins. Its tendency to become charged with static electricity causes it to attract dust and dirt particles. All such general handling problems can be troublesome with 35-mm film, and may be a little more critical with 70-mm wide film.

Humidifiers and vaporizers commercially available may be used to raise the relative humidity during the winter months. They must be controlled or carefully watched to keep the humidity from becoming too high, since this too is undesirable. A simple automatic humidstat is suggested, set to shut off the humidifier when the humidity is raised to 40%.

High humidities reached either during the summer months (or from the overuse of a humidifier) will make film limp and somewhat tacky; under extreme conditions they encourage mold growth. Tacky film will require increased force to pull it through the projector trap and may encourage emulsion deposits along the rails.

Chance of Mold Damage

The possibilities of mold damage on motion-picture film in frequent use are slight, but long storage under high humidity conditions can make a great many things look like cheese aged in a damp cave. First traces of mold growth on film will appear in the image as a hair-thin net pattern visible in the projected image and showing up first in the white areas. To minimize such problems during film storage moist blotters and similar sources of water must never be included within a film can.

High humidity can be reduced by commercial electric dehumidifiers which operate like small refrigerators. These, too, should be controlled with a humidstat so that they run only until the humidity is reduced to about 50%.

Extremes of weather conditions in the projection room, as we have pointed out, introduce some film handling problems that will require more care and caution from the projectionist. When either condition becomes extreme, the projectionist should recommend limited humidification during winter months or limited dehumidification during the summer.

Multi-Language Instruction By RCA Electronic System

INDIVIDUAL INSTRUCTION in as many as 10 foreign languages to students in the same classroom is possible with electronic advances announced by RCA. A control console has been added to the RCA Language Laboratory system, enabling a teacher to tune in an individual student in his sound booth, monitor his work, and offer advice without disturbing other class members.

The new console broadens the scope of the RCA system, which has as a key unit a transistorized amplifier, measuring only 3x8 inches, and permits selection of up to 10 language channels.

This concept now may be adapted to virtually any institution of learning, from grade school to university. It may be leased or purchased. It employs pre-recorded lessons which are received in the student booths via headphones from a tape recorder. During a pause between each "master" voice transmission, the student repeats exactly what he has heard and can compare his accent, inflection and pronunciation with the original. Since the amplifier can be flush-mounted, the bookshelf may be kept clear for the student's books or other material.

Airline's Regular Movies

French T.A.I. airliners are the first to show movies to their passengers on an every-flight basis, according to *Oil Progress*, quarterly publication of California Texas Oil Corp. (Caltex). T.A.I. flies between Paris and New Zealand and has many a long-distance passenger over its 13,750-mile route.

Setting up projector and screen in the restricted interior of a comparatively narrow and crowded aircraft so that all passengers can see adequately has always proved a stumbling block; but T. A. I. concluded, after a survey, that movies were just what their long-distance passengers needed.

At last a solution was found — the simultaneous showing of the same film on two screens.

The Projection Setup

The dual screens, one at the forward end of the tourist class cabin and the other on the partition separating tourist and first-class accommodations, solved the viewing problem nicely. Dual projection was accomplished ingeniously by a prism-periscope arrangement attached to the lens of the projector, which was suspended from the ceiling of the plane and could be removed easily after the show. The film's soundtrack was transmitted over the loudspeaker system of the plane.

Following a rather clever suggestion to show films depicting life in the countries over which the plane was flying, T. A. I. obtained from the Caltex library films covering a dozen Eastern Hemisphere nations. The showings are said to be a complete success.

[NOTE: Herb Griffin of International Projector Corp. accomplished this same stunt about 20 years ago for Pan American. It was strictly on an experimental basis, and the airline did not follow through with the idea.—ED.]

Projector Conversion Unit

A simple and inexpensive method for converting a standard 35-mm movie projector to television use was described recently by Dr. Jasper S. Chandler of Kodak Research Laboratories. The method essentially changes the film "pull-down" sequence of a movie projector so it can be used with a Vidicon television storage tube.

The conversion method costs only a fraction of the price of more complex

systems for showing standard 35-mm films on TV, Dr. Chandler said. The conversion, which uses an $\frac{1}{8}$-horsepower motor for projector power, mounts on the side of a standard projector with no special fittings, he said.

Alternate Speeds Used

In standard projectors, film is advanced at regular intervals by what is known as a Geneva mechanism. The new conversion unit alternately speeds up and slows down the action of the Geneva drive so the projector is "in step" with the TV Vidicon tube. Use of the new conversion unit prevents flicker in the televised movie, since the film "pull-down" is synchronized with the Vidicon tube.

The low-cost method of providing a TV projector produces very little added noise or stress on the film, so it should give long operating life. The converter is used experimentally in Kodak Research Laboratories in studies of film projection for TV.

Kodak Aid to Education

AID-TO-EDUCATION contributions amounting to more than $600,000 were announced by Eastman Kodak Co. Under the company's program this year, 75 direct grants and 44 fellowships were awarded American colleges and universities. During the past five years, Kodak's total expenditures under the plan have amounted to more than 3 million dollars.

The direct grants for 1959, valued at nearly $300,000 were given to privately-supported colleges and universities. There are no restrictions on the manner in which these grants may be used. The grants are based on the number of graduates of these institutions who joined the company five years ago and are presently employed.

Character of Grants

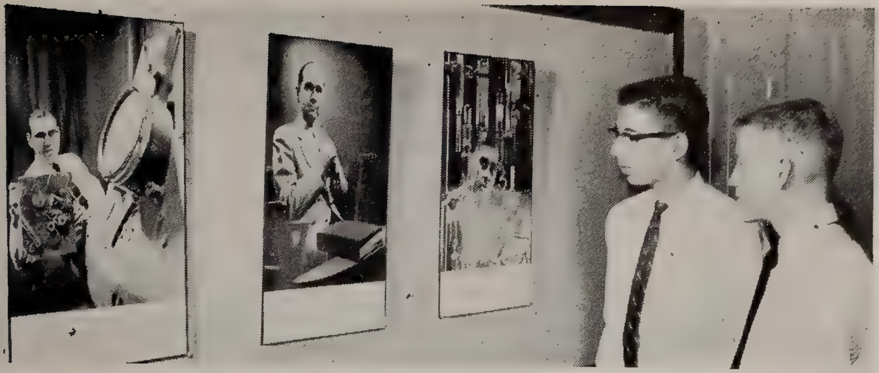
The fellowships for the 1960-61 academic year are valued at more than $150,000. Thirty one of the fellowships will be awarded to persons studying for the Ph.D. degree—20 in chemistry, three in chemical engineering, three in physics, and five in business. Thirteen fellowships will be awarded to students working toward the M. S. degree in engineering.

Additional contributions totaling about $200,000 were also announced by Kodak. These contributions were made to educational groups such as the United Negro College Fund, the National Fund for Medical Education, the Empire State Foundation of Independent Liberal Arts Colleges, and the Affiliated Independent Colleges of Tennessee Valley. Special grants were also made to colleges and universities located in areas where Kodak has major manufacturing interests.

Kodak Science Pictures

EASTMAN KODAK has developed a series of "scientists at work" photographs designed especially to stimulate student interest in science in Rochester, N. Y., area schools. The 11 photos series are warm, friendly close-ups in color. They show scientists, with their equipment, concentrating on projects at Kodak Research Laboratories. The result of a suggestion by a high-school teacher, the photographs are proving a useful aid to teachers in science classrooms.

The photographs may be related to studies in chemistry, physics, biology, physiology, optics, or mathematics. The researchers in the pictures have educational backgrounds ranging from high school to the college Ph.D. Their work varies from laboratory assistant to a senior research associate. One aim of the pictures is to "humanize" scientists for the students. For this reason, each photograph and brief caption is accompanied by biographical information. This tells how the scientists have prepared themselves for their work through mastery of scientific theory during school years or, in some cases, at night



THAT'S FOR ME! **Students view Kodak science pictures depicting Research Laboratory activities at an exhibit in West High School, Rochester, N. Y. Photo series was made expressly to aid teachers in science classrooms and thus excite pupil interest in careers in science.**

school. But it tends to correct any impression that only a genius can become a scientist.

Seventeen sets of the "Scientists at Work" series have been on loan to the schools this year. The series is made available without charge on a loan basis for three weeks by Kodak's public relations department.

Electronic Training Aid

THE COST of electronic training has been sharply reduced by the introduction of a new type of training aid described in a bulletin now available. The new device consists of a flat plastic board containing a rectangular array of contact cells. Wires may be electrically connected by inserting their ends into one of these cells, each of which consists of an electrically isolated, gold-plated eyelet and an elastic rubber core.

The bulletin describes how the new Model 23 Circuit Board, as it is designated, may be used in the classroom to allow students to build and rebuild circuits using standard components purchased in bulk. Normally the cost of components damaged by repeated soldering has prohibited instructors from scheduling lab-type courses in electronic theory.

Copies of the bulletin are available from Plastic Associates, 185 Mountain Road, Laguna Beach, Calif. (Catalog Sheet 901-B).

Two-way message transmission using meteor trails allows messages to be sent at speeds up to 4800 words a minute—80 times faster than present teletype transmission. Study by National Bureau of Standards shows that communication via intermittent meteor bursts can compete effectively with other long-distance systems, and is relatively free from ionospheric disturbances which affect long-distance communication in the high-frequency range.

* * *

Magnetic gating amplifiers driving silicon controlled rectifiers in power control units may replace conventional electromechanical equipment such as amplidynes and motor generator sets. Universal Power Control Units provide voltage current regulation, AC servo motor control, DC motor speed and position control, and temperature and light-dimming control. Military uses: missiles, jet, and conventional aircraft, ground support-handling equipment, and radar; industrial applications: semi-automatic or completely automatic control systems.

SERVING ART THROUGH TECHNIQUE

(*Continued from page* 10)

scratches. Meanwhile the manufacturers of projection equipment are more inclined to work on a double-purpose projector for both 35- and 70-mm films which does not seem to difficult to build.

Aberrations and Distortions

Would not the final solution be to print on a 70-mm film the images taken on a 35-mm film with a horizontal run? This solution (adopted by Technicolor) has the enormous advantage that the equipment in the laboratories for the whole negative processing operations would not need any modification. Such a solution would permit, during the shooting, the use of anamorphosis with a factor of 1:5, exactly the one for which we struggled

in the meetings of the Commission Technique du Cinema Francais.

By shooting on a normal 35-mm film we demonstrated the superior results obtained from a technical point of view (by minimizing aberrations and distortions), as well as from an artistic point of view, the aspect rate of the image being then 1:75.

Do we want to go further ahead with the rejuvenation of the motion picture show? Then it would be well to recall —those copying are not gracious enough to mention their predecessors—that the French cinema had that honor, a long time ago, of showing in practice that these ideas were possible. It was Grimoin-Sanson who, during the world exhibition in 1900, thought out a panoramic projection, with the device he called "Cineorama," using cameras. It has been utilized anew in a less perfect way by Walt Disney with his "Circarama."

It was Abel Gance who, with the help of A. Debrie, used three screens for his film "Bonaparte" (1926). This triple screen is coming to life again in America under the name "Cinerama," and in Russia as "Kinopanorama."

It was Prof. Henri Chretien who proposed anamorphosis, to obtain results more easily with the "triple screen," and who also designed the Hypergonar (1928) optical system. It was 25 years before this was used—but alas! with very poor discrimination.

Technique no End in Itself

The same Gance and Debrie were the men who, for a new show of the film "Napoleon" in 1934, equipped Le Paramount in Paris* with a device for an automatic orientation of the sound. The results were far better than those anticipated 20 years later for the costly and complicated stereophonic device with four magnetic tracks (out of standards). As against all this, one can offer the reasonable solution of a universal copy with two magnetic tracks, as proposed by our Bureau de Normalisation de l'Industrie Cinematographique.

As can be seen, there is no lack of technical means; but experience has taught us that *the technique must not be an end in itself*. In a book, we find these words, full of meaning, by M. Fourre-Cormeray, who was the first Director of the Centre National du Cinema:

"Just as for the printing process, the cinema is only a technical medium, to be used by men for conveying a message. Because it took its shape in the 20th century, it is a complicated instrument, an expensive instrument, but in the end only a medium. To prove it, I can say that the cinema may be used for all sorts of purposes: telling the news, explaining scientific experiences, enabling us to participate in the emotions of a drama or in the joy of a comedy."

Let us stop our digressions now, and come to a conclusion. For this purpose, it would be well to repeat the words by which M. Fourre-Cormeray summarized the ideas already mentioned:

"The cinema has just reached boyhood. In its mature age it will certainly perfect and enlarge what it is now doing for science and art. Thus the specific genius of each nation will be conveyed to the world."

* Mention of Le Paramount in Paris evokes memories of World War II when this theatre served as a "drop" for escaped Allied fliers on their way to the Spanish border. Entrance was effected over the roofs of adjoining buildings into the projection room, on the door of which appeared the peremptory notice in French to the English equivalent of "Extreme Danger—Explosive. Positively No Admittance."

Incidentally, Harry Rubin, director of sound and visual projection for Paramount Theatres, U.S.A., introduced sound pictures to France at the Le Paramount in 1929.

MODERN SCIENCE NOTES

Replacement for transistor diodes may be tiny electrical charges tunneling rapidly through silicon, germanium, and compounds of gallium and indium, according to G.E. Research Labs. Charges are collectively called a *tunnel diode*. They resist nuclear radiation damage. Diode components are so small that radio transmitter (including battery) the size of 50-cent piece has been built with them. Tiny radio has transmitted to FM receiver nearby.

ACOUSTICS, SPEAKERS & VOLUME CONTROL

(*Continued from page* 6)

sharp peak at approximately 2500 cycles.

It was pointed out in IP some time ago that theatre sound reproduction could be raised to the high standards of home hi-fi quality by substituting for the large speaker units a "battery" of several dozen 6-inch dynamic speakers mounted on a suitable baffle behind the screen.* Not only is the sound quality of such a battery superior to that of excessively large theatre speakers, but the need for separate speaker channels for the high and low frequencies is eliminated.

Radical Change Suggested

It has been demonstrated by the N. V. Philips' Gloeilampenfabrieken, The Netherlands, that a "sound column" consisting of a large number of small loudspeakers mounted vertically one above the other, and all operating in phase, is a more efficient transducer of sound than a single large speaker. Part of the increased efficiency is due to sound reinforcement-interference effects which concentrate the sound in

* "Loudspeaker Characteristics and Sound Quality," by R. A. Mitchell, IP for March 1958, p. 5 *et seq.*

a wide horizontal beam and attenuate it above and below the extremities of the column. In other words, the loudspeaker column "focuses" the sound over the audience area where it is needed.

Installations of Philips' sound columns have been made indoors and outdoors in Europe largely for the purpose of reinforcing "live" sound—human voices and musical instruments. Combined with a novel sound-delaying device manufactured by Philips, an acoustically dead cinema auditorium or recording studio can be given the "brilliance" of a correctly designed concert hall.**

Bass response below 300 cycles is somewhat attenuated by appropriate filters for sound-reinforcement purposes to avoid reverberant effects caused by the reduced damping of the relatively non-directional bass frequencies. When speaker columns are used as the primary sound source, as is the case with motion pictures, the frequency response should be extended down to the lower limit of 30 or 40 cycles.

Column Mounting at Sides

The use of two such sound columns installed in baffles at the sides of a motion-picture screen, or in the vertical columns of the proscenium, will serve to improve sound quality, eliminate speaker resonance effects, insure a more uniform distribution of sound throughout the seating area, and make unnecessary back-of-the-screen speakers.

Elimination of the perforated sound screen is a distinct advantage. The perforations occupy from 6 to 12% of the total screen area, but the loss of picture brightness often exceeds these figures as circulating air deposits dust around the edges of the holes. Solid screens, moreover, give clearer as well as brighter pictures, are longer lasting, less expensive, less likely to be damaged, more easily cleaned, and, unlike perforated plastic screens, may be completely restored by repainting.

Speaker columns located in the sides of the stage proscenium serve for both monaural and stereophonic reproduction. The two columns are operated in phase and equally energized for monaural sound; and the sound appears to most of the audience to emanate from the surface of the picture screen. For stereo reproduction the two columns are also operated in phase, but are separately energized by the left and right stereophonic channels. The center channel of 3-track records is divided between the columns.***

Regulating Sound Volume

Regulation of sound volume is always a difficult task. Even if the sound system be of excellent quality and expertly installed, and the auditorium acoustics ideal for motion-picture sound, reel-to-reel differences in recording level, line-current fluctuations, and the varying size of the audience require frequent, and sometimes drastic, changes in the fader setting. Differences in audiences are undoubtedly the most important.

Audiences affect the volume level in two ways: they absorb sound (especially the higher frequencies), and they create extraneous noise.

Sound reflections from the backs of lightly upholstered theatre seats create more reverberation than is commonly supposed. These sound-reflecting backs are covered by the patrons, hence a large audience has the same effect on the sound as the addition of sound-absorbing materials to the seating area. Moreover, the heavier clothing worn in the winter in cool climates has a more pronounced sound-damping effect than light summer clothing.

The greater the damping, the smaller the "reinforcing effect" of reverberation, and the higher the fader setting must be to maintain an acceptable level of sound volume.

Audience Noise Important Factor

The effect of audience noise on the intelligibility of the reproduced sound is tremendous and variable. This is a factor which the projectionist, isolated in his relatively soundproof projection room, cannot directly perceive. He has, of course, learned by experience that the sound volume must be

** "Modern Acoustical Engineering," by D. Kleis, *Philips Technical Review*, Vol. 20, No. 11, p. 309 *et seq.*

*** Electrical phasing difficulties inherent in 3-track CinemaScope prints are minimized by reserving only a certain number of the speakers in each column for the center channel alone and introducing the requisite switching arrangement. Acoustic phasing is not as critical as electrical phasing.

increased during a Saturday matinee because an audience composed mostly of children is unavoidably noisy; but he can seldom tell, at other times, when excessive whispering, scuffling, laughter, and the rattling of candy wrappers require a higher level of volume.

The sound that the projectionist hears from his monitor speaker in the projection room has little relation, qualitatively or quantitatively, to the sound heard by the audience in the auditorium. The projectionist can only begin playing a film at an average normal level for his theatre, using normal dialogue as his guide. This means that some of the music may come over much louder than the theatre manager or the ushers think proper, and that some of the sound effects will be very soft.

Projection Room Control?

Movie sound has a much wider dynamic range than radio or TV sound (which is so much "compressed" that the announcer's voice is often as loud as a symphony orchestra playing double-fortissimo); and the sooner untrained managers, ushers, and candy girls get wise to the fact that the *normal speaking voice* is the criterion for sound volume, the better for long-suffering movie audiences.

The *isolation* of the projectionist is the reason a full-time trained sound observer is needed in the auditorium. Also, the projectionist can only rarely hear small sound defects over the whir of the projectors, the roaring of ventilating fans, and the whine of motor-generator sets. Not even "motorboating" can be heard in some projection rooms!

To avoid unpleasant "echo" effects in the auditorium, monitor speakers do not reproduce the lower bass frequencies. They accordingly give no indication of sound quality but merely inform the projectionist that the sound system is operating. It is the job of the auditorium sound observer to keep an ear on the *quality* of the sound as well as its loudness level.

Projectionist Isolation Unfortunate

It is unfortunate that the projectionist cannot hear the sound as it is reproduced in the auditorium because, in the last analysis, the projectionist must bear the responsibility for sound quality and accept the blame even for defects he does not hear! Again, he must rely upon the ears of his sound-observing assistant in the auditorium —though not wholly.

As stated in the October issue of IP (p. 22), no projectionist should be without a set of headphones which are connected across either the power-amplifier output or the lines which go to the stage speakers. With a good set of high-impedance earphones thus connected, the projectionist can listen in on the *quality* of the sound whenever he wishes. Tightly coupled to the ears, the headphones provide high-fidelity reproduction and shut out most of the machine noise. The only thing they do not reveal is the reproduction quality of the stage speakers.

How is the auditorium sound observer (*not* an usher or someone else who has other duties) to communicate with the projectionist? The time-tested buzzer system—one buzz for more volume, two for less—can hardly be improved upon. An intercom telephone in the foyer will allow the observer to describe sound defects or prevailing auditorium conditions to the projectionist instantly.

Projection Room Control N.G.

It is generally agreed that the ideal solution to the volume-level problem is an auxiliary volume control manned by a competent sound observer in some out-of-the-way corner of the auditorium. When it is possible for the volume to be regulated by an assistant downstairs, the projectionist is relieved of at least the most irksome part of his sound responsibilities.

Any projectionist who thinks he can do a better job of sound control from his soundproof booth must possess what Hindu mystics call the faculty of "super-normal hearing." The most the projectionist can do is *guess* what the correct volume should be and thank his lucky star that the permissible maximum-minimum loudness range amounts to a latitude of several decibels.

Although auditorium control of sound volume appears generally desirable, some projectionists maintain that the projectionist, himself, is in the best position to know whether the sound is too loud or too low. It is certainly true that a projectionist is best fitted by training to judge sound volume, but, being isolated from the auditorium, he can hardly be expected to be constantly aware of the changing audience conditions which call for rather frequent adjustments of volume level.

If the projectionist would himself advise the auditorium sound observer, these differences of opinion would be avoided.

Norelco® UNIVERSAL 70/35mm PROJECTOR

NORTH AMERICAN PHILIPS COMPANY, INC
Norelco®

the original PHILIPS/TODD-AO®

...known by the company it keeps

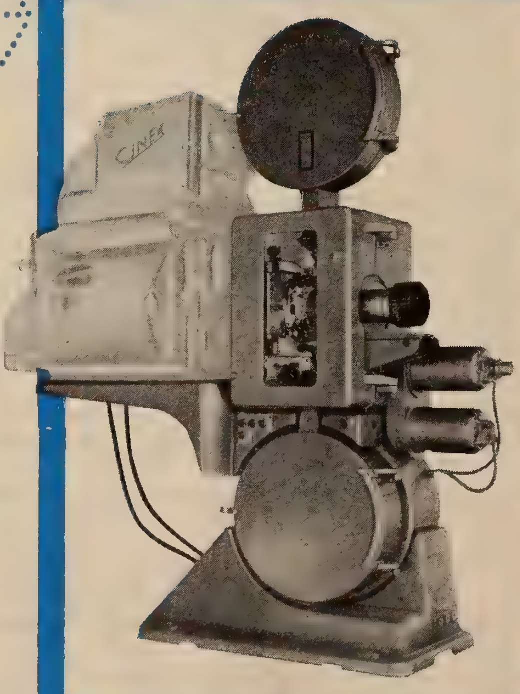
Continuous in-service operation is the acid test of the quality and reliability of the NORELCO multi-purpose projector, DP 70. Every one of the nation's seventy-nine theatres – and seventy-five more throughout the world – equipped for Todd-AO and all other 70mm processes, furnishes proof of the NORELCO's efficiency, versatility and outstanding performance.

The NORELCO DP 70 was designed from the ground up, specifically as a 70mm to 35mm universal projector. It is not an adaptation of a 35mm machine and is, therefore, unique among 70mm projectors. Small wonder, then, that long print life is routine with the NORELCO projectors. Runs as high as six hundred per print have been reported from theatres.

In view of the investment involved in equipping your theatre or drive-in for 70mm, you owe it to yourself to demand nothing less than *concrete* evidence of *proven* excellence before you determine *your* choice of a universal projector. And, based on the available evidence—in the projection booths and on the screens of the world's leading theatres—investigate the superior performance and obvious economy of NORELCO projection equipment available now.

Here is your check-list of many outstanding features of the NORELCO DP 70, the original and only time-proven 70/35mm projector:

- *Fully compatible with, and quickly convertible for: 70mm or 65mm film with up to six magnetic sound tracks; 35mm CinemaScope with four magnetic or single optical sound tracks, and Perspecta-Sound, Wide Screen film of any aspect ratio with either magnetic or optical sound and standard 35mm film.*
- *Scientifically compounded curve of light gate—prevents film buckle.*
- *Single blade, double speed conical shutter, providing highest light transmission of any projector. Leading and trailing edges have integral air scoops that aid in dissipating heat.*
- *Rollers, drums, sprockets and film gate made from non-magnetic materials—eliminates possibility of magnetic sound track damage and necessity for frequent degaussing. Dual sprockets on all shafts machined of hardened aluminum alloy. No sprocket change required when changing from 70mm to 35mm or vice versa. (Less than 4 minutes required.)*
- *Two independent motors on each projector, 24 and 30 fps—all past, present or contemplated 70mm films can be projected without additional expense or modification.*
- *Combination ten-track magnetic clusters, no tricky threading required when changing from six- to four-track reproduction.*
- *Triple filtered metered lubrication system.*
- *Substantially constructed for rock steady projection.*
- *All modern, domestic high-power arc lamps adaptable without loss of efficiency.*
- *Lathe bed lens carriage, positive alignment of lens to film path.*
- *Factory installed internal wiring, reduces installation costs.*
- *Adjustable for all projection angles—from 28 degrees downward to the upward angles required in drive-ins.*
- *Complete stock of replacement parts always available.*
- *Fully Underwriters' Laboratories Approved.*



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Atlanta, Ga. .... *Roxy Theatre*
Atlantic City, N. J. ... *Virginia Theatre*
Baltimore, Md. .... *New Theatre*
Beaumont, Tex. ...... *Liberty Theatre*
Boston, Mass. .... *Astor Theatre*

Boston, Mass. .... *Gary Theatre*
Boston, Mass. .... *Saxon Theatre*
Buffalo, N. Y. .... *Century Theatre*
Buffalo, N. Y. ...... *Granada Theatre*
Chicago, Ill. ...... *McVickers Theatre*
Chicago, Ill. ..... *State Lakes Theatre*
Chicago, Ill. .... *Todd's Cinestage*

Cincinnati, O. .... *Valley Theatre*
Cleveland, O. ... *Loew's Ohio Theatre*
Columbus, O. .... *Hunt's Cinestage*
Corpus Christi, Tex. ... *Tower Theatre*
Dallas, Tex. .... *Tower Theatre*
Dallas, Tex. ..... *Wynnewood Theatre*
Dayton, O. ... *Hunt's McCook Theatre*

Denver, Colo. .... *Center Theatre*
Detroit, Mich. ...... *Mercury Theatre*
Detroit, Mich. . *United Artists Theatre*
Ft. Wayne, Ind. .... *Clyde Theatre*
Hartford, Conn. .... *Strand Theatre*
Hollywood, Cal. *Carthay Circle Theatre*
Hollywood, Cal. ..... *Egyptian Theatre*

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Houston, Tex. .... *Uptown Theatre*
Indianapolis, Ind. ...... *Lyric Theatre*
Jacksonville, Fla. . *Five Points Theatre*
Kansas City, Mo. .... *Capri Theatre*
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New York, N. Y. . *Loew's State Theatre*
New York, N. Y. .... *Rivoli Theatre*
New York, N. Y. .... *Warner Theatre*
Oklahoma City, Okla. .... *State Theatre*

Omaha, Nebr. .... *Cooper Theatre*
Philadelphia, Pa. .... *Boyd Theatre*
Philadelphia, Pa. ... *Goldman Theatre*
Philadelphia, Pa. .... *Midtown Theatre*
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Pittsburgh, Pa. .... *Nixon Theatre*
Pittsburgh, Pa. ...... *Warner Theatre*

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Providence, R. I. ... *Elmwood Theatre*
Richmond, Va. .. *Willow Lawn Theatre*
Rochester, N. Y. ..... *Monroe Theatre*
Sacramento, Calif. . *Alhambra Theatre*
Salt Lake City, Utah ..... *Villa Theatre*
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San Francisco, Calif... *Coronet Theatre*
Seattle, Wash. ... *Blue Mouse Theatre*
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St. Louis, Mo. ... *Ambassador Theatre*
St. Louis, Mo. .... *Pageant Theatre*

Syosset, N. Y. .... *Syosset Theatre*
Syracuse, N. Y.. *Shoppingtown Theatre*
Syracuse, N. Y. .... *Eckel Theatre*
Tampa, Fla. .... *Britton Theatre*
Toronto, Ont. .... *Tivoli Theatre*
Tulsa, Okla. .... *Ritz Theatre*
Vancouver, B. C. ..... *Stanley Theatre*

Washington, D. C. .... *Uptown Theatre*
Youngstown, O. .... *State Theatre*

INTERNATIONAL PROJECTIONIST

JANUARY 1960

VOLUME 35 NUMBER 1

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INTERNATIONAL

PROJECTIONIST

Including a special Audio-Visual section relating to the operation and maintenance of A-V equipment in the educational and industrial fields.

Volume 35 January 1960 No. 1

EAST COAST OFFICE
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New York 17, N.Y.
RAY GALLO
General Manager

MIDWEST OFFICE
Tenth Floor Upper Midwest Bldg.
Minneapolis 1, Minn.

FRANK W. COOLEY, JR.
Editor and Publisher

R. ENTRACHT
Associate Publisher

RAY GALLO
General Manager

R. A. MITCHELL
Technical Editor

In This Issue . . .

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MONTHLY CHAT

Old Fables Die Hard

THERE IS A WORLD of difference between the facts of life in motion-picture projection and the fancies concocted by technologists dwelling in ivory towers. Cloistered laboratories somehow isolate the scientific mind from workaday reality. A scientist is not an artist just because he knows how to manufacture paints and canvas. Likewise, a technologist is not a projectionist — a showman — just because he knows how to make a good lens.

C'Scope's Curved-Screen Fiasco

We projectionists have learned by experience to be on guard against the ridiculous misinformation frequently purveyed by the pseudo-scientific trade journals. For instance, a technologists writing in one such publication tells us that "it is to be concluded that the curved screen has now become a *permanent part* of motion-picture projection." Concluded by whom? Certainly not by anyone who has observed the trends in projection at close range since the advent of CinemaScope and the wide screen generally since 1953!

To their credit, Twentieth Century-Fox functioned as the midwife in the delivery of the anamorphic process to the wonderful world of show business. But indulging in a slight excess of wishful thinking, 20th-Fox envisioned the newborn infant as a sort of substitute Cinerama and 3-D process combined—which CinemaScope definitely is not.

Now, Cinerama employs three synchronized films and projector installations to produce an effective "visual surround" upon a strongly curved, specially constructed screen of tremendous aspect ratio. The 1-strip CinemaScope process, excellent and indispensable though it be, never did and never can duplicate the overwhelming audiovisual impact of the *novelty process* known as Cinerama.

The Myth of Screen Curvature

The *curved* screen has *only one* visual effect in 35-mm projection, namely, *intolerable distortion of the picture.* Part of this distortion is caused by projection angle (although this factor can now be corrected optically by ingenious new lens attachments), but most of the distortion may be attributed to the indisputable fact that straight lines on a curved screen are not straight at all, and cannot possibly appear straight except for observers located in one very small section of the viewing area, *correcting lens or no correcting lens.*

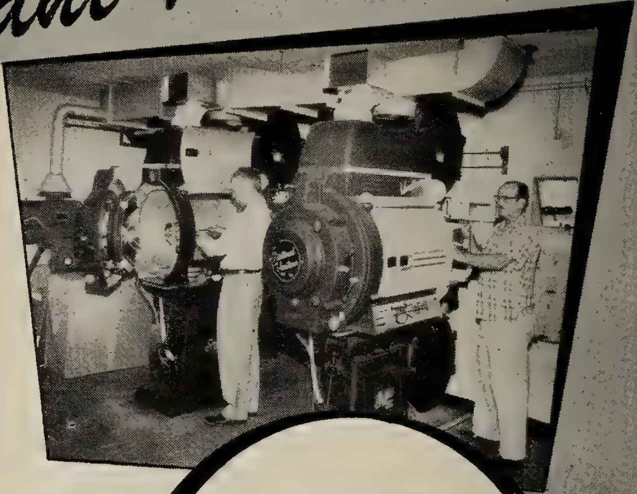
To repeat our own considered statement anent screen curvature (IP for May 1959, page 9):

"A *flat* CinemaScope screen appears exactly as 'enveloping' as a *curved one!* A curved screen provides no illusion of 'depth' because the viewing distances are somewhat beyond the limit of clear

(Continued on page 18)

Designed for Projecting All Film Widths

1st CHOICE WITH THOSE WHO WANT BIG Brilliant Pictures!



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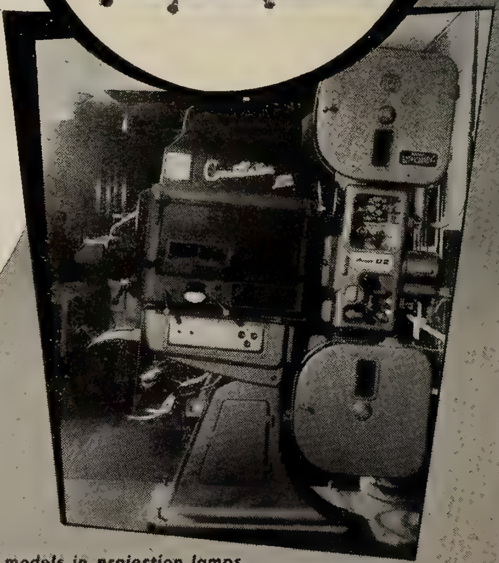
Proved against all makes of lamps to be the world's most powerful projection arc. No other lamp comes even close. Employs a totally new and different technique—a three dimensional, cylindrically shaped light source—and a 21-inch reflector, the largest ever used. Projects up to 56,000 lumens, double the light of any lamps using 16½″ reflectors, 51% more than lamps using f1.7—1.8 lens.

Aperture spot size is changed by a convenient control of the position of the main reflector. The burner position need never be changed. Exceptionally cool operation.

"35/70 SPECIAL"

Meets the optical requirements of every 70 mm projector. Also projects 35 mm without changing reflectors. Accommodates full 20-inch carbon trim. Each carbon driven by separate motor. SINGLE adjustment controls the feeding rate of both carbons. Arc position adjustable without disturbing relative carbon positions or equillibrium of arc.



NATIONAL CONSTELLATION "170"

The optical system can be quickly changed to meet the requirements of the various projection systems. The auxiliary lens patterns the spot to the aperture size and shape, utilizing all useful light for projection to the screen. Water-cooled carbon contacts.

Fully automatic arc crater positioning systems are standard equipment on all three of these lamps at NO EXTRA COST! The reflectors swing out with the rear door so as to permit easy cleaning.

National also offers six other models in projection lamps for meeting the needs of all size theatres. See National today.

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INTERNATIONAL PROJECTIONIST

Volume 35 January 1960 Number 1

Equalizing Projectors for Sight and Sound

By Robert A. Mitchell

Noticeable changes in projection quality on changeover can be prevented through competent operation, matching of equipment.

AMONG THE DEFECTS in projection considered especially annoying by filmgoers are bad focus, uneven and discolored screen illumination, picture jump, improper sound volume, and noticeable sudden changes in the quality of the projection when changeovers are made. The last defect is unavoidable when the others are present because it is unlikely that both projectors would be malfunctioning in the same way and to the same degree.

The use of more than one projector in a theatre installation is necessary, of course, for uninterrupted performances. A few very large theatres have three, or even four, projectors, providing even more opportunity for projector imbalance to show up at changeovers. And even the most subtle changes in pictures and sound quality are noticed by movie partons.

Nearly every motion-picture audience includes a few individuals who are aware of the fact that two projectors are normally employed, and they know *just enough* about the projection process to determine (by glancing up toward the projection room) which of the two projectors is malfunctioning. It bodes our craft no good when such a patron informs the manager which projector is performing like a mechanical lemon.

"Projectionists" versus "Operators"

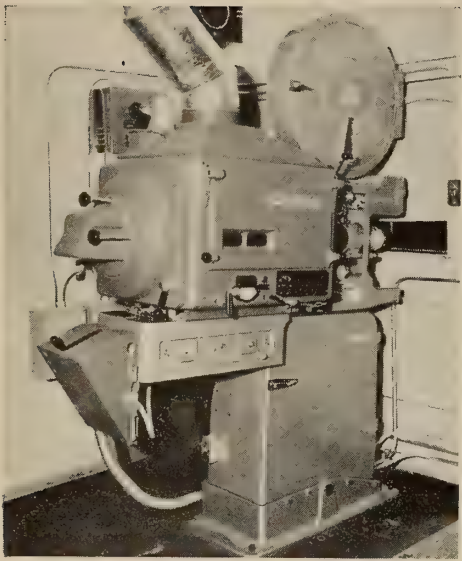
IP has frequently repeated the truism that "competence is the only commodity the projection craft has to sell," for without competent handling of the sight-and-sound process there is nothing worthy of the name *projection.* We therefore find it incredible that the denizens of certain projection rooms simply don't give a damn how the picture looks or sounds so long as film travels through the mechanism. We hesitate to call such fellows *projectionists;* they are "operators," and not competent ones, either!

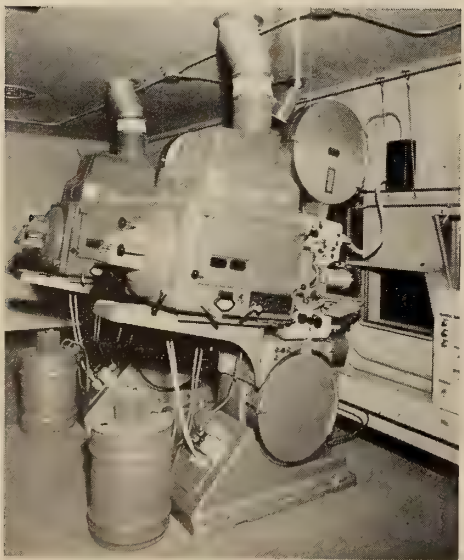
Like anyone else, a projectionist is not personally enthralled by each and every picture that comes along. But a good projectionist never forgets that the motion-picture industry strives to cater to *all* tastes. *There are all kinds* of audiences; and the films that would bore one audience may enchant another, and *vice versa.* Because every audience deserves our best efforts, *every* film must be projected as well as it can be projected. This involves the ethics of our craft. It does not seem quite ethical to take special pains with an "art" film which draws a small, select audience, and allow a western that packs the house to run out of focus just because the hackneyed plot isn't worth a twist of the focusing knob!

Laying aside his personal preferences in the matter of film fare, therefore, the truly *professional* projectionist views the picture as an optical image, and the sound as an electro-acoustic reproduction. He may privatly damn the short-sightedness and inanities of Hollywood, but he is not satisfied *as a projectionist* until the image and its accompanying sound reproduction are as good as film and equipment allow him to make them. Fortunately for the industry in these days of a return of the public to the movies, the vast majority of projectionists adopt this professional attitude, and there is nothing "sloppy" about their work.

Watch that Focus!

Poor focus stamps projection as "sloppy" as does nothing else. When one projector is consistently operated out of focus, the audience is made painfully aware of the mechanics of the process at every changeover. For every eighteen or twenty minutes of a sharp, easy-to-view image, there is an equal in-





terval of eye-straining blur. The audience indirectly pays our salaries: is this the best we can do for them?

The maintenance of sharp focus is an important facet of the projectionist's art, a job that requires a watchful eye and a skilled hand. *There's no such animal as an automatic focusing device* — you have to perform the operation yourself. Focus should be checked (1) at the commencement of each reel and (2) again when the reel is about halfway through. Arc currents in excess of 100 amperes may require more frequent focus checks, especially if short-focus lenses be used.

It's the "operators," not the "projectionists," who set the focus once at the beginning of the day and expect it to hold until midnight. The "operators" place their trust in focusing scales and marks on the lens barrel, and seldom bother to look at the screen. The "projectionists" not only use their eyes at frequent intervals, but enlist the aid of low-power binoculars or screen telescopes when their projector lenses have focal lengths longer than 5 inches.

It goes without saying, of course, that bad focus is not always the projectionist's fault. A conscientious projectionist really suffers when a "fuzzy" print comes his way. The projected picture can never be clearer than the image printed on the film; and the larger the screen, the worse an out-of-focus picture looks. Excessively high arc currents produce out-of-focus effects by aggravating the rapid flutter and buckling of the film at the aperture; and the use of lenses under 4 inches E.F. makes the picture very difficult to keep in focus, as is well known in these days of VistaVision and cropped apertures for non-anamorphic projection upon wide screens.

These *unavoidable* causes of blur nevertheless cast no aspersions upon the projectionist's competence when conditions are the same in *both* projectors, as they should be.

The use of *different* makes, models, or "speeds" of projection lenses in the projectors can cause sufficient difference in the appearance of the pictures projected by the two projectors to make change-

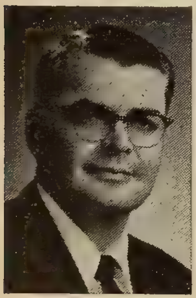
(Continued on page 17)

International Projectionist Adds to Staff; Expands Reader Services

NEW YORK — Both the management and technical staffs of International Projectionist have been bolstered by the addition of new personnel and new printing methods in an effort to make International Projectionist even more useful to its readers, advertisers, and the industry itself, R. Entracht, publisher, announced here recently.

Through a merger with The Northern Publishing Company, a midwestern magazine publishing firm, additional clerical and management staff members will be able to contribute to the enlargement of International Projectionist services.

Entracht, in moving the New York office of the publication to 545 Fifth Ave., said IP will gain by the consolidation of offices with Ray Gallo, general manager of the



Cooley

Ray Gallo

Northern Publishing company, and now a vice president and general manager of International Projectionist. Additional services to eastern subscribers to International Projectionist will be handled from this East Coast office, with Projectionist readers in the Midwest and West Coast being served from the midwestern office, Suite 1000, Upper Midwest Building, Minneapolis 1, Minn. Telephone numbers are: New York, Murray Hill 7-7746, and Minneapolis, Federal 2-8401.

Advertising sales and service will be handled by Gallo from the East Coast branch office; the editorial and circulation offices will be in Minneapolis.

Robert A. Mitchell, for many years a contributing editor to International Projectionist and the author of Mitchell's "Manual of Practical Projection," has been promoted to be technical editor of International Projectionist, working closely with Frank W. Cooley, Jr. president of Northern Publishing, editor.

Ray Gallo is a veteran motion picture publication executive with over 30 years experience in the motion picture equipment field. Born in Chicago in 1902, A. Raymond Gallo entered the theatrical field early as an actor, a stage and company manager in vaudeville, stock and touring companies and later in independent screen production, as manager of the Associated Author's Productions in Florida.

He was publisher and editor of theatrical papers such as The Stage and the Chicago Vaudeville Weekly, and was on the staff of King Features Syndicate and the Boston Herald. His theatrical career was climaxed by the production of stage plays in New York and Philadelphia.

Gallo joined the Quigley Publications in 1926 as presentation editor and advertising manager of better theatres. At the time of his resignation to establish his own publisher's representation business he was in charge of equipment advertising for Quigley. He is a member of the Society of Motion Picture and Television Engineers, the Association of Motion Picture Advertisers, the Author's League of America and the Dramatist Guild of America.

R. Entracht will act as advisor to Gallo in New York, will maintain offices for International Projectionist and will participate in the publication's expanded services to its readers in convention coverage and local news.

Frank Cooley, as editor, will assist Mitchell in expanding the editorial coverage of International Projectionist and make more technical information available to the projectionists, audio - visual and television engineers and technicians throughout the world, whose only independent contact with the science of motion picture projection comes through the pages of International Projectionist.

The Northern Publishing Company of Minneapolis and its publication affiliate, The Lakewood Press, Inc., is familiar with the motion picture industry and the importance of proper motion picture projection and equipment through its publication Greater Amusements, the oldest trade publication in the industry devoted exclusively to motion pictures, serving the exhibitor. Other publications of the company include Duluth Port, a publication serving the Seaway Port of Duluth Authority and users of the St. Lawrence Seaway, Sporting Goods Journal, a monthly dealer publication for boat and marine dealers and sporting goods outlets, and the Shakopee Argus-Tribune, a weekly newspaper operated by its Lakewood Press affiliate.

* * *

United States Exports Of Motion Picture Film, Equipment Higher

United States exports of motion-picture film and equipment in the first nine months of 1959 were valued at $31,724,664, slightly higher than exports for the same period of 1958 totalling $31,661,-120, according to statistics announced by Nathan D. Golden, director of the Scientific, Motion-Picture, and Photographic Products Division, Business and Defense Services Administration, U.S. Department of Commerce.

Foreign shipments of unexposed motion-picture film (all gauges) in the three quarters of 1959 amounted to 527,964,693 linear feet valued at $13,210,463, an increase of 27.9 per cent in quantity and 13.1 per cent in value compared with the same period of 1958. Increases were recorded in all categories except 35-mm negative motion-picture film. There was a slight drop in the exports of processed motion-picture feature films over the same period of 1958 due, primarily, to increased overseas printing from dupes and master positives.

Total foreign sales of all types of motion-picture equipment, including cameras, projectors, sound equipment, and studio equipment during the first nine months of 1959 were values at $10,394,683, about 8 per cent below the same period of 1958 with shipments of $11,323,581. While the exports of 35-mm and 70-mm projectors increased from 658 to 957 units, the exports of arc lamps fell from 1,499 to 718 units. In the projector category, only the sales of 16-mm silent projectors decreased.

IA Locals Elect Kinsora; Defenbaugh

DETROIT — Frank Kinsora of the Palms Theatre, president of Local 199 for about two decades until some five years ago, was returned to office for the 1960-61 term, succeeding D. Faye Erskine, of the Woods Theatre. Other new officers; vice-president, Melvin Donlon, Beverly Theatre; secretary-treasurer, Joseph Sullivan, Mercury Theatre; recording secretary, Jack Lindenthal, Arc Theatre; business representative, Roy R. Ruben, Fox Theatre; board members, Gerritt Lamb, Clifford Vericker and Fred Warendorp, and sergeant at arms, Louis Stathos.

Dan Defenbaugh was elected president of the projectionists Local 735, covering southeastern Michigan towns outside of Detroit. This local voted some time ago to merge with Detroit Local 199, but is retaining its separate identification for the time being. Other new officers: vice-president, Richard Rank; recording secretary, Norman Pingel; treasurer, George Konath; business agent, Roy Suckling; sergeant at arms, Clarence Bushart; delegate, Roy Suckling, and alternate, Roy Defenbaugh.

* * *

NATHANIEL F. COLLINS, SR., 71, died in Atlanta early in November after a long illness. He will long be remembered as a pioneer of motion-picture projection. The late Mr. Collins was chairman of the Atlanta Licensing Board for projectionists at the time of his death.

Audio-Visual . . .

The illustrations on page 14 show graphically the use of front-surface mirrors — projectionists will find that, in Figure 1, "Opaque" and overhead transparency projectors employ flat front-surface mirrors to redirect and reverse the image-forming beam focused upon a screen by the objective lens. In Figure 2, by making use of thinly silvered front-surface mirrors, TV optical multiplexers make it possible to use one vidicon camera tube for several projectors, slide and motion-picture. Because a TV camera tube costs several hundred dollars, the multiplexer effects a great economy.

TV Hailed as Exciting New Educational Tool

A flood of educational-television brochures and reports, indicative of the importance of the new instructional medium, has inundated IP's offices. TV is hailed in all of this material as the greatest boon to education since the invention of writing, itself. Representative publications are "How Instructional Television Works in New York State," issued by the University of the State of New York, State Education Dep't, Albany, and "The Superintendent's Viewpoint on Educational Television" published by the Thomas Alva Edison Foundation, Inc., 8 West 40th St., New York 18.

At the present time almost every academic course in public-school and college curricula is being taught over U.S. TV, both commercial, educational, and special closed circuit. According to reports, more than a half million students in the U.S. are receiving a portion of their classroom instruction via the picture tube. All reports agree on the following results:

(1) More rapid and thorough learning with fewer class disciplinary problems.

(2) Students in TV classes make more frequent and extensive use of library materials.

(3) Use of TV economizes teaching time and classroom space.

(4) Use of superior teachers improves techniques of other teachers.

These results are also confirmed by the Ford Foundation study, "Teaching by Television" (Office of Reports, Ford Foundation, 477 Madison Avenue, New York 22).

TV teachers unanimously agreed that the new medium provided the most exciting experience of their careers. Said one: "At last I have had time to teach the way that every teacher dreams about."

Color Films Draw Better, British Survey of Preferences Indicates

Next to the star, color is a film's most important boxoffice ingredient. The appended Kodak, Ltd. report from Great Britain is relayed by our esteemed contemporary, the Kinematograph Weekly of London.

COLOR FILMS attract high attendances and, further more, if more color films were made there would be a cumulative effect at the boxoffice. These were the findings of a market research program carried out by Kodak and described by R. A. Leeks, B.Sc., A.I.S., at a recent meeting of the British Kinematograph Society, London.

A chart was presented to show which factors influenced moviegoers to see a particular film. First, of course, were the names of actors and actresses; second—rather surprisingly—was the factor of color. Third factor was the preview trailer: press reviews and word-of-mouth were well down on the list. Another chart indicated that story value, stars, and photography contributed most to the enjoyment of a film.

The general attitude toward color revealed tinting as a "must" for musicals, adventure and Biblical pictures, but many persons preferred black-and-white for crime and mystery films.

For a special series of experiments, two films of very different type were shown in color and black-and-white. By the cooperation of Columbia Films and Technicolor, B&W prints were made of two color films, "The Admirable Crichton" and "Gideon's Day." All references to color were eliminated from the monochrome versions, and so far as possible the test audiences were left unaware that the films were originally in color.

The films (extracts from which were projected at the BKS meeting) were shown at the Hammer Theatre, London, to invited audiences who were unaware of the purpose of the showings. Members of the audiences were asked to rate the entertainment value of the films.

"The Admirable Crichton" was thought to be very good by 49 per cent of those who saw it in B&W, and by fifty nine per cent of those who saw it in color. "Gideon's Day" was voted very good by 35 per cent of the people who viewed it in B&W, and by 48 per cent of those who saw it in color.

Mr. Leeks pointed out that there was a 10 per cent swing in favor of a film simply because it was in color. He argued that the drop in British cinema attendance during the past two years may be associated with the reduction in the proportion of films made in color—from 45 per cent in 1956 to 28 per cent in 1958.

"One cannot say that any single film made in color will automatically attract more patrons," declared Mr. Leeks, "but the enjoyment of the film could be measured by the desire of the audience to return to the cinema more frequently than would otherwise be the case."

Replying to George Gunn, Mr. Leeks stated that, in the questionnaire relating to their enjoyment of films, few persons referred specifically to color, but there was a number of references to photography.

Howard Bailey wondered whether the fact that the films in the test showings had been photographed in color made the B&W quality inferior; another member pointed out that if the films had been shot in B&W, different techniques would have been used to direct attention — for instance, a red hospital blanket was unnoticeable in the monochrome version.

Asked whether his findings had been correlated with actual boxoffice figures, the speaker pointed to the difficulty of securing reliable data. (Denis Wratten stated that the figures given for the two films shown did tie up with boxoffice results.)

George Gunn expressed the opinion that the percentage preference for color would defray the extra cost of production.

"Kodak," replied Mr. Leeks, "has contributed to the reduction in color costs in two ways: there have been reductions in the cost of the new Eastman Color materials, and the increased negative speed has been of material assist-

ance in reducing production costs."

R. H. Cricks (well known to readers of IP as an occasional contributor on projection topics) asked whether the effect of seeing black-and-white after color had been assessed, and the speaker declared that no evidence of such an effect was presently available.

On the American scene, a survey of current release charts reveals that, of some 58 pictures tentatively scheduled by the major Hollywood distributors for release in the first four months of 1960, 27 are in color. Two companies (M-G-M and 20th Centry-Fox) are releasing more films in color during that period than in black-and-white.

* * *

Projector Carbon

A 13.6 rotating projector carbon that burns slower while providing better light distribution has been developed by Ringsdorff Carbon Corp., according to a recent announcement by Arthur Worth, sales manager of Diamond Carbons.

The improvements are also features of Diamond's 10 and 11mm carbons. Diamond carbons are available through National Theatre Supply and independent distributors.

* * *

John B. Fitzgerald of Cleveland Dies at 70

CLEVELAND — John B. Fitzgerald, 70, an International Representative of the IATSE since 1942, died Jan. 12 in a local hospital, where he had been a patient for several days. He has been troubled with a heart condition for several years.

A member of Cleveland Stage Employes Local 27 beginning in 1912, he had been its president since 1929, following 14 years as business agent. He was also president of Cleveland Studio Mechanics Local 209.

He had served as president of the board of trustees of the Ohio Soldiers and Sailors Home, where he was raised, and as legislative agent of the Cleveland Federation of Labor. He was also active with the National Labor Relations Board in the Cleveland area at the time it was first established.

sentative of the IATSE since 1942,

Requiem mass was held at St. John's Cathedral.

Melvin Schleiter Dies In St. Paul at 54

ST. PAUL—Melvin Karl Schleiter, 54, died here recently.

Mr. Schleiter was born in Berlin, North Dakota and was a veteran professional motion picture cameraman. He had resided most of his life in St. Paul, although he did spend a few years in California prior to joining Reid Ray Film Industries in 1934 as a cameraman.

Mr. Schleiter, in his 25 years as a cinematographer, travelled all over the United States every year for his firm. Several mechanical improvemnts in motion picture developing machines and camera attachments were a result of Mr. Schleiter's skill in mechanical engineering. A number of these devices are in current use.

He was in charge of the photography of the State of Minnesota Centennial film, "An Agricultural Portrait" which received a Certificate of Merit at the 1958 Venice Film Festival and was accepted for screening at the Brussels World Fair. He was a charter member of Local 666 IATSE, and an active member of the Society of Motion Picture and Television Engineers. He was a member of Macalester Lodge 290 and Osman Temple of the Shrine.

He is survived by his wife, Oleta, a son, William, a daughter Christy, his mother, Mrs. Charles W. Schleiter, all of St. Paul; brothers Bernard M., St. Paul, Captain Howard Schleiter of Scotch Plains, New Jersey, and sisters, Bernice Michaelson of Minneapolis and Mildred Cranfill of Long Beach, California.

* * *

New Widescreen Lens Makes Debut in London

LONDON—A new widescreen process—tentatively known as the "Broneski system" after its U.S. inventor — has been unveiled in London via "Honeymoon," Michael Powell production shot in Spain last spring in Technirama 70. The new gadget consists of an optical device which, when attached to a conventional 35-mm projector, is said to give a picture as encompassing as Cinerama.

"Honeymoon," lensed by the new device, will be reduction-printed on 35-mm film for release by Lion International this year.

Book Review . . .

Prospects for Video Tape In Future Detailed

Ranging the field from what video tape is and how it has changed television to its prospects for the future and case histories of its successful use, a new 60,000-word illustrated "handbook on all aspects of video tape" has just been issued by Minnesota Mining and Manufacturing Co. (3M), world's only commercial producer of the tape.

Infromation Service

The book inaugurates a 1960 information service by 3M, designed to keep users and potential users of video tape abreast of all significant developments in this fast-moving area, according to the St. Paul firm.

Titled "THE CHANGING PICTURE IN VIDEO TAPE FOR 1959-1960: A REVIEW FOR THE TELEVISION INDUSTRY (SECOND EDITION, OCTOBER 1959)," the book is a result, its preface states, of a demand far exceeding expectations for the March 1959 first edition, of which more than 6,000 copies have been distributed to date.

The current second edition, the preface continues, is three times as large as the first and is an almost entirely new book.

It contains many photos; detailed footnotes which serve as a practical bibliography of video tape literature; cross-referencing of subjects; and blank pages at the end of each section so that the book may be kept up-dated.

Monthly Technical Bulletins

Among other features of 3M's planned 1960 video tape information program are:

A series of monthly "Video Talk" technical bulletins.

Comprehensive news-style roundups of such topics as shooting and editing with video tape, educational use of video tape, and advertising with video tape.

Copies of the new second edition of "The Changing Picture in Video Tape for 1959-1960" may be obtained at $1.50 each to cover production and handling by writing Box No. 3500, St. Paul, Minn. Checks should be made payable to Minnesota Mining and Manufacturing Co.

AS EVERYDAY AS LUNCH...*the hunger*

PICTURES fill a definite human need. They take people out of their homes—out of themselves—away from cares of the day! That's why people like to think about pictures; why they like to talk "pictures," like to go to them . . . like to get their friends to go with them!

Sound reasons, these, for making each picture better—better story-wise—better technically—better to see—better to talk about—in short better box office!

Sound reasons, too, for closer co-operation with the Eastman Technical Service for Motion

It's what's on the screen...and what people

AS EVERYDAY AS LUNCH... *the hunger for good pictures and the talk about them!*

PICTURES fill a definite human need. They take people out of their homes—out of themselves—away from cares of the day! That's why people like to think about pictures; why they like to talk "pictures," like to go to them . . . like to get their friends to go with them!

Sound reasons, these, for making each picture better—better story-wise—better technically—better to see—better to talk about—in short, better box office!

Sound reasons, too, for closer co-operation with the Eastman Technical Service for Motion Picture Film . . . maintained to help the industry solve problems of film selection, production and processing, and exhibition . . . dedicated to the principle that *the better the picture the better the box office!* Offices at strategic locations. Inquiries invited.

Motion Picture Film Department, **EASTMAN KODAK COMPANY**, **Rochester 4, N.Y.**

East Coast Division: 342 Madison Ave., New York 17, N.Y. *Midwest Division:* 130 East Randolph Dr., Chicago 1, Ill. *West Coast Division:* 6706 Santa Monica Blvd., Hollywood 38, Cal.

WIDE SCREEN
COLOR

It's what's on the screen...and what people say about it...that counts

Front-Surface Mirrors: Their Structure, Function, and Care

AN ORDINARY looking-glass is a crude form of "optical flat," an item of great importance in certain visual-education and television optical devices. Unlike a concave mirror, a flat mirror does not act like a lens and focus the reflected rays to form an image. It merely causes the rays to bounce back without changing their directions *relative to one another*.

When you see smething in a flat mirror, the object seems to be as far behind the glass as it really is in front of it. This is because each ray bounces off the reflecting surface at an angle which is exactly the same as the "angle of incidence," but opposite in direction. Think of a beam of light as a shower of tennis balls thrown at an angle upon a smooth, flat pavement, and you will understand the laws of reflection.

Any highly polished solid surface, or the smooth surface of a liquid, will reflect *some* of the light in the manner of a mirror; but the metals and special interference films are the best reflectors known. ("Total reflection" from the interior surfaces of prisms, polished diamonds, and other transparent substances is 100 per cent efficient.) Now, polished glass, alone, reflects only 5 or 6 per cent of the light falling upon it head-on (more of the light impinging at an angle), while freshly burnished metals reflect much more (silver, 92 per cent: aluminum, 82 per cent; rhodium, 76 per cent; chromium, 60 per cent).

An ordinary glass mirror, therefore, is essentially a *film of silver*, so far as its reflective powers are concerned. The plate glass serves only to support the thin metallic film and keep it flat and smooth. The glass protects one side of the film: the reverse side is usually insulated from the air by a coat of varnish or paint. This is very important in the case of silver, a metal which is readily tarnished by the sulfurous fumes generally present in the air.

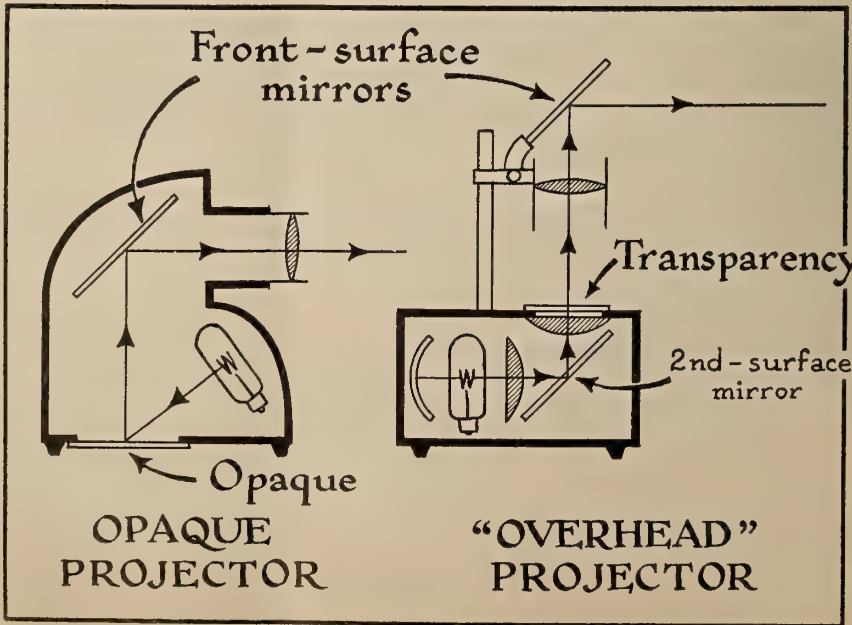
Even though a second-surface silver mirror reflects a total of about 88 per cent of a perpendicular beam of light, a mirror of this type — the ordinary kind — is unsuitable for use in an *image-forming* beam even though it be made of the best precision-ground optical plate glass. The reason is to be found in the *double reflection* that blurs the image — one reflection from the backing of silver (about 82 per cent of the light, including absorptions by the glass), and the other from the exposed front surface of the glass (6 per cent).

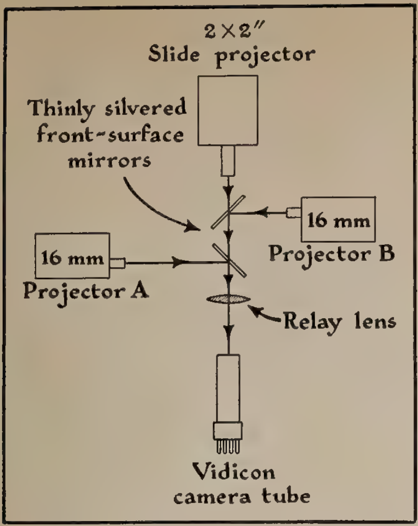
Such optical instruments as opaque and "overhead" projectors, as well as the optical multiplexers used in TV studios to permit one vidicon camera tube to receive the images projected by one slide projector and two 16-mm motion-picture machines, must accordingly make use of *front-surface* mirrors having the reflecting film of metal deposited upon the *outer* surface of perfectly flat plate glass. A single optically true reflection is produced because the light does not pass through the glass, but is reflected *in toto* from the exterior metallic surface.

The tarnishing of a silver-coated front-surface mirror is unfortunately rather rapid under ordinary indoor atmospheric conditions, there being nothing (except an exceedingly thin film of transparent protective lacquer in some cases) to prevent contact with the air. For this reason, vacuum-deposited aluminum, a more tarnish-resistant metal, is preferred to chemically deposited silver.

Special Care Needed

An ordinary silver-backed mirror is cleaned by washing the front glass surface, an operation which poses no problem because the glass is relatively thick, tough, and hard. Vigorous scrubbing of a front-surface optical mirror, on the other hand, will quickly ruin the very thin, very soft film of aluminum even when a protective overcoat of thin lacquer has been applied. Special care must be exercised in handling and cleaning these front-surface mirrors if the optical efficiency of the opaque projector or





multiplexer is to be preserved.

Never touch the reflecting surface of a front-surface mirror with the fingers! Fingerprints are hard to remove without damaging the metal film. If the only dirt present is dust, gently brush the surface with a clean camel's-hair brush or, in severe cases, lens tissue or a soft, dust-free cotton cloth.

Outing-flannel is much too linty to use for cleaning optical surfaces even though one manufacturer recommends it for his front-surface mirrors.

Beware of Fingerprints

To remove accidental fingerprints, breathe upon the reflecting surface and rub *very gently* with lens tissue or clean cotton cloth. Lens cleaner or a weak solution of pure soap in distilled water may be used for overall washing, which should always be followed by a distilled-water rinse and drying by *very gentle* wiping with a clean, dry, soft cotton cloth.

The less frequently a front-surface mirror is cleaned, the longer it will last. A few specks of dust will not appreciably impair the optical performance of the mirror.

* * *

16-mm Printed Leader

HOLLYWOOD, CALIF.—Film leader, printed with any desired text, is offered to film libraries by Consolidated Film Industries. Lettering may be in any style or combination of styles, and may cover such information as company name, instructions for return of films, and company seal or logo.

More information is available from Consolidated Film Industries, 959 Seward St., Hollywood 38, Calif.

Tv and the Crisis in our Classrooms

HEREWITH the concluding installment of RCA's progress report on educational TV. The reported results exceed the expectations of even the most sanguine protagonists of TV teaching.

Well-informed critics of educational TV have nevertheless suggested *filming* the sessions *in color* and presenting them on large screens via high-intensity projection. In this way, it is argued, the subject matter and its manner of presentation would acquire a degree of permanence, and its cost per pupil lowered by reuse.

The big question: Is a large-screen, high-definition, full-color motion picture a more effective teaching tool than the small, low-definition screen of a TV receiver?

How effective has TV proved itself as a teaching tool? While many TV experiments have not been under way long enough to have produced definitive results, there is wide agreement among educators on the following points:

1. *Most educational television experiments have grades as good as, or better than, conventional class-room instruction.* A nationwide survey by The Ford Foundation, involving more than 100 public school systems, showed that TV students did better in 68 out of 110 different kinds of comparisons. At Washington University in St. Louis, 46 per cent of the TV students taking freshman mathematics earned A or B grades, as compared with 30 per cent of the non-TV students.

2. *Pupils themselves tend to prefer TV teaching.* Among the most frequently cited reasons are that there are fewer distractions, that the novelty of television makes the class more interesting, and that the teachers seem better prepared. At Hagerstown, 58 per cent of the pupils indicated that they thought they learned more in a classroom with TV than without it, and 68 per cent said they found the televised lessons more interesting. One student described his reaction this way: "In class, the teacher talks to *us.* On TV, she talks to *me.*"

3. *TV can extend the influence of the most talented teachers.* On "Continental Classroom," Dr. Harvey White teaches as many students as it would take a conventional instructor, lecturing to five regular classes a day, 1,300 years to teach. Not long ago, fifth-graders in the Pittsburgh public and parochial schools had a memorable experience of seeing and hearing the poet Robert Frost read some of his verse. With TV the pupil in the rural school can get as expert instruction as the pupil in New York or Chicago. By bringing outstanding teaching to the attention of many classroom teachers, TV can also be a boon in improving the training of teachers themselves.

4. *TV can help a teacher cover subject material far more rapidly than can be done by conventional instruction.* An experiment with a literature course at New York University showed that three times as much material could be covered in a televised lecture because of the teachers' better preparation and the absence of interruptions.

Tenth-grade geometry students at Hagerstown were fully one month ahead of classes of previous years after the first six months of instructions. In some cities the teacher time saved through the use of TV in large classes has made it possible to offer far more personalized instruction for both the slow learners and the gifted pupils.

5. *Television can bring about substantial savings in education.* At Penn State, a careful cost analysis for four specific courses disclosed that TV teaching had saved as much as $38,000. Put another way, the unit cost per student-credit for these four courses was $2.72 for TV teaching, against $4.80 for conventional instruction.

At Miami University, it was found that televised instruction could "break even" when 220 students were taught simultaneously. The Southern Regional Education Board's plan for a sixteen-state network, connecting 309 colleges and universities, contemplates an eventual cost of instruction per student semester hour of $2.80, compared with present costs in some of the larger institutions in the South of $12 to $18.

In these and other ways, the

experiments with educational television have amply confirmed TV's ability to broaden the nation's educational horizons.

As The Ford Foundation and The Fund for the Advancement of Education, two sponsors of teaching by TV explained in a recent report:

"Today the question is no longer *whether* television can play an important role in education. That question has been answered in the affirmative . . . . The question that now needs fuller exporation is *what kind* of a role television can play most effectively."

In an effort to explore this vital question, RCA is collaborating with New York University on a Center for Instructional Television which began operation in September.

The first of its kind in the United States, the new Center has two sections — one concerned primarily with studio teaching and the other with the classroom use of televised presentations. The Center's program includes teacher-training, apprenticeships, workshops, consulting services, and research. RCA has provided $100,000 in funds and equipment.

* * *

New Splicing Tape Offered by Robins

Guaranteed non-bleed characteristics combined with permanent holding qualities and uniform tape thickness and features of the new Robins magnetic splicing tape.

"Our new white tape," states Larry Post, sales manager of Robins Industries Corp., Flushing, N.Y., "is the hottest thing to hit the tape recording market and is guaranteed by Robins against drying out or ever becoming brittle."

The new Robins tape will be merchandised in convenient ½" x 100" rolls and retail at $.50 each. Other "consumer" size rolls will also be produced.

Outstanding qualities of this new splicing tape include a Dupont Mylar film backing 1.5 mil thick, tensile strength: 25 lb/in width, adhesion 35-40 oz/in. gauge or caliber: .002-.0025, resistance to solvents: excellent, 0° hold: 1,000g (acetate) 18 days.

Industrial use of this splicing tape is expected to be heavy as it was specially formulated to withstand temperature extremes.

* * *

Exhibitors Group Urges Early Release Of 70-mm in 35-mm

A demand was made at a recent Miami meeting of National Allied, an exhibitors' organization, that distributors promptly make films produced in the 70-mm gauge available to theatres in 35-mm "on regular release and with early availability." So began an attack on current distribution policies for the 70-mm product.

"If 70-mm films are exhibited as roadshows in a few theatres and are withheld from general release for long periods of time," contended a resolution drawn up at the meeting, "it will create a bottleneck greatly aggravating the current picture shortage. It is small comfort to exhibitors to read about plans for increased production if they cannot gain access to the top attractions."

The resolution was stated to have been inspired mainly by the way Loew's plan to handle the 70-mm M-G-M attraction "Ben-Hur."

"The board cannot escape the conclusion that 70-mm pictures are a device or 'gimmick' for increasing the waiting time of the independent subsequent-run and small-town theatres," continued the exhibitor resolution. "The unfairness of such a device for blocking the free flow of product seems obvious. When 70-mm pictures are issued in considerable numbers, as planned, the practice will be detrimental to the film companies, themselves."

Calling for the prompt release of the 70-mm productions on 35-mm film, the resolution contended further that "the 70-mm process involves no new principle in photography or projection, and it adds little or nothing to the clarity or definition of a picture except possibly on outsize screens. The claims made for 70-mm projection are in contradiction to the claims made for VistaVision."

The board of National Allied expressed "alarm and indignation" over the fact that special advertising campaigns are being conducted in specific areas to induce the residents thereof to attend an alleged "exclusive" exhibition of 70-mm pictures (such as "Ben-Hur") in the nearest cities in which runs have been granted, Sometimes located 100 miles or more from the communities in which advertising is done.

(R. A. Mitchell, technical editor of IP, comments that, aside from the increased depth of focus of the lenses used — a very minor factor, to be sure, — there are no advantages definitionwise to the 70-mm process over the regular 35-mm projection method except on exceptionally large screens of drive-in dimensions. In such situations 70-mm prints make possible a higher level of screen illumination. For all but a few indoor theatres, maximum screen quality has been attained by 35-mm CinemaScope prints reduced and anamorphosed, or horizontally compressed, from 70- or 65-mm vertical-travel negatives, or from VistaVision or Technirama horizontal-travel 35-mm negatives.)

* * *

James H. Parks, 71, retired Detroit projectionist, died recently. He was formerly chief projectionist at the Vogue Theatre, Detroit.

Albert Richard "Al" Light, projectionist at the Jam Handy organization, Detroit, died recently from a heart attack despite emergency surgery and cardiac massage. He is survived by his wife, Ruth, a daughter, and three brothers, also projectionists: Gilbert E. Light, business agent of IATSE Local 199; Francis Light, projectionist at the Motor City Theatre; and Roy Light, projectionist at WXYZ-TV.

EQUALIZING PROJECTORS
(Continued from Page 7)

overs perceptible *even when two lenses have exactly the same focal length.* It is extremely unwise, for example, to use an uncoated lens in one machine and a coated lens in the other. The projectionist, in such a case, may be the victim of necessity; but such a state of affairs is not good for the exhibition business. These remarks apply in equal force to CinemaScope anamorphic attachments.

Very similar to this is the use of different kinds of arc mirrors in the two lamps—or even one new

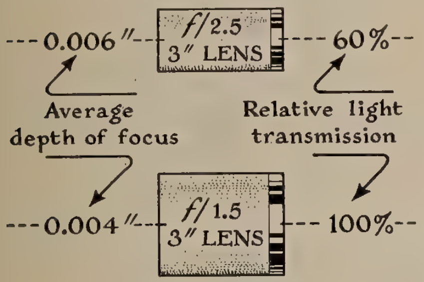


FIG. 1—Lenses of different speeds have different light transmissions and different optical characteristics even though their equivalent focus (E.F.) is the same. The lenses in a 2-projector installation should therefore be identical in speed, type, and make as well as in E.F.

and one old mirror of the same brand and specifications. Except for a brief period of testing and comparison, a dichroic ("cold") mirror should never be paired with a silver mirror. The light from one machine may be dimmer than that from the other, and of a perceptibly different color — slightly more yellowish, bluish, pinkish, or greenish. A change of screen-light color at the changeovers is most noticeable during the showing of black-and-white prints.

Difference in arc-lamp adjustment also cause mismatched light, but the projectionist should not rely wholly on the tape-measure and the alignment rod, necessary as these aids are. Small differences in mirror focal length, arc current, mechanism shutter transmission, and port-glass transmittance can result in a brighter light from one machine even when the geometric focus (distance from the positive crater to the center of the mirror) and the working distance (center of mirror to film aperture) are the same in both machines, and both lamps are in perfect optical alignment.

1. Nevertheless, the *first step* in equalizing the light from both projectors is to line up the lamps according to the manufacturer's instructions, and with his recommended alignment tools (available through dealers and service companies). The centers of the mirror, arc crater, light cone, projector aperture, and projection lens will then all lie on the same *straight line* — the optical axis, — and the suggested optimum focus and working distances will have been established.

2. The individual arc currents are then checked. Trim both lamps with new, dry carbons, making certain that you have the same positive and negative carbon protrusions beyond the burner jaws in both lamps. "Burn in" both lamps for about a minute, establish the same arc gap, and note the current consumed by each by reading the ammeter. The difference, if any, should not exceed 2 or 3 amperes. If a greater difference in current consumption exists, and it is certain that the ammeters are reading correctly, adjustments should be made in the rectifier transformers or the motor- generator ballast rheostats.

3. Project blank light to the screen (both projectors running, but without film) and change over from one machine to the other several times in rapid succession to detect visible differences in the brightness, distribution, or color of the screen illumination. The most exact determinations require the use of a light meter or photographer's exposure meter, but the equalization is close enough if no difference can be detected *visually.*

Arc Focus and Color of Light

If a difference can be seen, the working distance of the mirror in the "dim" lamp should be adjusted by trial and error to see if shortening or lengthening this distance by small increments steps up the brightness to the level obtained with the other lamp. (It may be necessary in the case of some lamps to move the entire lamphouse forward and back on the projector lamp table.) As a rule, moving the mirror closer to

(Continued on Page 20)

MONTHLY CHAT

(Continued from Page 3)

stereoscopic perception.

"All that screen curvature accomplishes in both conventional and CinemaScope projection is poor focus toward the sides of the picture in some cases and *gross* geometric distortion of the depicted scenery in *all* cases. Screen curvature *cannot* be conformed either to significant projection angles (without expensive special lenses) or to various angles of view from the audience area."

Throw 'Em Out: They're Obsolete

Readers of the article referred to are well aware of the fact that the focal field of a projected motion picture curves in the direction *opposite* screen curvature, a prime cause of uneven focus across the screen in many theatres.

The cure for the distorting effects of curved screens is a matter of simple surgery: they must be replaced with flat screens. Projection quality has improved remarkably in the thousands of theatres where this has been done. These include such notable showplaces as the Radio City Music Hall in New York and the Metropolitan Theatre in Boston.

Our personal reaction to the curved screens we encounter at the present time is easily expressed: certain theatre managements are too penny-pinching to rectify the technical boner perpetrated upon the exhibition industry by a too optimistic view of the visual possibilities of the new anamorphic widescreen process. This is 1960, not 1953.

R. A. MITCHELL

* * *

New Emde Frame

A new double-fold, aluminum foil mask with ultra-thin cover glass for the new Kodak Cavalcade projector magazine frame is announced by Emde Products Inc., Los Angeles, manufacturers of a complete line of slide binding materials.

This latest Emde aluminum mask is offered in two sizes—35-mm double-frame, and Super-Slide and 127 size. In use, the film is merely inserted into the aluminum mask, the two pieces of ultra thin cover glass are placed on

either side, and the glass-mask "sandwich" is slipped into the Cavalcade frame.

This all-metal and glass binder minimizes the absorption of moisture, thus practically eliminating Newton Rings, fogging, and steaming, states the manufacturer.

A box of 100 aluminum masks and 200 pieces of micro glass is pricie at $7 for either size.

For more complete information on this latest aluminum mask and glass binder for the new Kodak Calvacade projector magazine frame, write to Emde Products Inc., 2040 Stoner Ave., Los Angeles 25, Calif.

* * *

Nazi Newsreels Given Industry Donor to UCLA

LOS ANGELES—Sixteen Nazi German newsreels, produced between 1940 and 1942, have been donated to the UCLA Theater Arts Dept., the gift of a Hollywood film industry donor.

Many outstanding military campaigns are presented from the Nazi point of view, including the battle of Britain. One of the 16 reels (whose total running time is about five hours) features the first Japanese footage of the Pearl Harbor attack.

The newsreels will become part of the UCLA Theater Arts Archives and Library.

* * *

Stereo Conversion

FLUSHING, N.Y. — Two new products for conversion of tape recorders to ¼ track stereo are announced by Robins Industries Corp.: a ¼ track stereo record/play-back head, designated Model 5Q8, and a ¼ track erase head, Model 9QE3.

The stereo recording head is electrically and mechanically interchangeable with all Robins M/M B&L series heads, which are original equipment on 75 per cent of current models, and will replace heads in many other recorders now in use with slight mechanical and electrical modification, according to Robins. Model 5Q8 is priced at $30, Model 9QE3 at $14.

More information is available from Robins Industries Corp., 36-27 Prince St., Flushing 54, N.Y.

Dr. Herbert T. Kalmus, Father of Color Film, Retires from Technicolor

Dr. Herbert T. Kalmus, father of the color film, retired Jan. 1 as president and general manager of Technicolor, Inc. and the Technicolor Corp. A founder of the company 45 years ago, Kalmus will continue with both branches of the organization as a consultant.

John R. Clark, Jr., executive vice-president, succeeds Dr. Kalmus both as president and general manager. Clark has been associated with Technicolor for the past 24 years.

The commercial history of Technicolor began in 1924. In that year Famous Players Lasky Corp., predecessor of Paramount Pictures, produced a picture titled "Wanderer of the Wasteland." This was the first important adventure of the Technicolor process (then confined to two "primaries," red and green), although earlier short films had been made as demonstrations. Another early Technicolor feature was Douglas Fairbank's "The Black Pirate" (1925). The main argument against color pictures at that time was that they tired and distracted the eye, took attention away from the acting, and blurred and confused action and facial expressions.

"The Black Pirate" was a box-office success, ,but a "terrible headache for Technicolor," to quote Dr. Kalmus. "Technicolor prints at that time were made by imbibing dyes into relief images, two of which were cemented back to back, thus creating a double-coated imbibition print. In the field these double-coated films would buckle first one way and then the other, so that the focus was uncontrollable."

By 1929 Technicolor had perfected the imbibition printing process which makes possible the transfer of the dyes from relief-image "matrix" printing films to the single gelatin layer of regular projection film. Warner's "On with the Show" was the first sound feature in Technicolor; but even though Technicolor pictures followed in rapid succession, the chromatic possibilities of the process were severely limited by the use of only two color components, red and green. The 3-color camera (red, green, blue) was introduced in 1932.

Technicolor contributed in important ways to the success of such widescreen developments as Cinerama (1953), the first CinemaScope color prints, and VistaVision. Technicolor responded successfully to the urgent call of Todd-AO, and provided 70-mm color prints of "Around the World in Eighty Days." The most recent adventure of Technicolor is represented by the Technirama process of photography and printing.

With Technirama one horizontal 35-mm negative is provided from which the following release prints may be made:

(a) Technirama double - frame anamorphic prints, either imbibition or multilayer.

(b) 70-mm color positive prints for use in Norelco, Victoria-X, Bauer U2, or Century 70/35-mm projectors.

(c) 35-mm CinemaScope imbibition or multilayer prints.

(d) 35-mm regular and VistaVision color prints.

(e) 16-mm imbibition prints.

Prints for road shows can be made by Technicolor processes whether the photography is by 65-mm Todd-AO, M-G-M Camera 65, or by Technicolor Technirama.

Dr. Kalmus states:

"Generally where various sizes and shapes of negative are employed and various sizes and shapes of screen picture are required, a process like Technicolor imbibition which employes projection printing yields the most satisfactory results. With contact printing, the employment of a dupe negative would be required with its attendant degradation of quality. In the Technicolor imbibition process, matrices are made by projection printing, and from each matrix an estimated average of 50 prints may be produced. The Technicolor imbibition process uses the negative sparingly, perhaps 10 or 15 times to manufacture 700 prints, whereas for other processes, the negative is used each time a print is made unless dupe negatives are employed.

EQUALIZING PROJECTORS

(Continued from Page 17)

the mechanism distributes the light more evenly over the screen; moving it farther away increases the brightness at the center of the screen. The arc (crater) position must be readjusted each time the working distance is changed, of course; and you should wait until both lamps are perfectly adjusted before setting the arc-indicator cards or arcoscope screens.

Very slight brightness differences can often be eliminated by adjustment of the arc (geometric focus) in one of the lamps; but this method should not be relied upon to "iron out" gross differences because changing the arc focus changes the color of the light. The light on the screen is yellowish when the crater is too close to the mirror, bluish when too far away.

Mechanism Light Obstructions

The use of different makes or models of projector mechanism on the two machines does not necessarily cause an inequality of screen-light balance, but whenever a light mismatch is obtained from a hybrid installation, do not fail to check the size of the openings in the shutter case and heat shield of the "dim" machine. It may be that these openings are too small to allow the light beam to pass through to the aperture unobstructed.

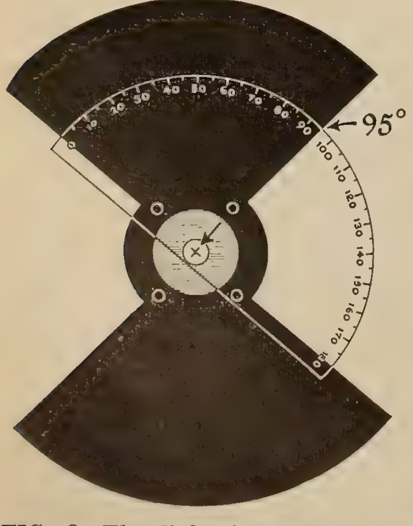


FIG. 2—The light transmission of a 2-blade shutter depends upon the angular width of the blades, measured with a protractor. The shutters in both projectors of an installation should have blades subtending the same number of degrees.

An obstinate case of brightness mismatch may require a recheck of the reflectance of the lamp mirrors and even if the angular width of the shutter blades in each of the projectors. Remember, it is *the angular width* of the shutter blades *in degrees* that affect shutter light transmission, not the actual size or diameter of the shutter in inches. Angular width, which should be *exactly* the same for the shutters of both projectors, is measured with a protractor, obtainable at almost any dime-store stationery counter.

Because the optical plate glass in the projector ports may absorb 8 or more per cent of the light, a noticeable brightness mismatch will occur if the glass is present in one of the ports and absent from the other. The average observer is able to detect a brightness difference in the neighborhood of 4 or 5 per cent.

Picture-Jump Test

More subtle causes of faulty picture equalization which make changeovers perceptible to the audience involve the lateral-guide flalnges and the intermittent movements. It is certainly true that if the picture projected by one machine is more or less jumpy, the difference in projectors will be noticed. We can state categorically that, unless the picture has been badly photographed or carelessly printed on the film, or the print is in poor physical condition, there is seldom any excuse for picture-jump or side-weaving.

The test for camera or printer jump is simple, although it cannot be carried out during a performance for an audience. The picture must be racked out of frame, with the frameline placed across the middle of the screen. The bottom half of the picture will occupy the top half of the screen, and the top half of the picture, the bottom half of the screen. If these two "picture halves" are seen to weave and jump *independently* of each other, and the frameline, itself, is rocksteady, the camera used for photographing the picture caused the jump. If, however, the two halves of the picture and the frameline all jump together *in the same direction*, either the projector is at fault or the sprocket holes of the print are worn out.

Sound Matching Important

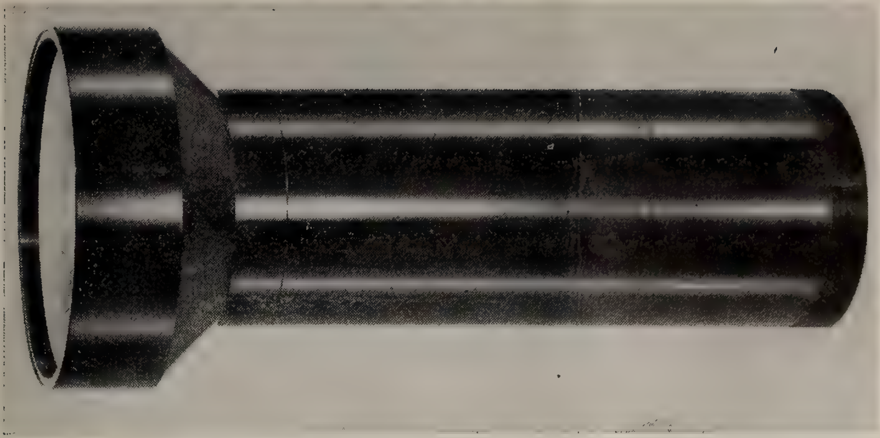
The sound reproduction can also call attention to the change from one projector to the other. This will occur if the sound from one projector is distorted or weaker than the sound from the other. Careful listening tests should be made of the sound-on-film reproduction (both optical and magnetic) obtained with each projector. Run tracks of good quality (preferably test films of piano music to test sound quality, continuous tones for output level), and do not depend on the projection-room monitor. Use earphones or send an experienced listener to check on the sound from the auditorium.

Most modern sound systems employ small potentiometers for the photocell load resistance in the optical soundheads or their preamplifiers. The outputs of the two soundheads are matched by painstaking adjustment of these potentiometers while identical test loops are run simultaneously.

Certain old-style systems depend upon exciting-lamp rheostats to adjust exciter voltage, and hence the brightness of the scanning beams. The correct procedure is to adjust both exciting lamps horizontally and vertically for maximum output, and then match the two outputs by reducing the greater one.

Just as the average observer can detect brightness differences as small as 4 per cent, the average listener can, under favorable conditions, detect loudness differences as small as ½ decibel. The outputs of the two projectors should, therefore, be matched to within ½ db. Sound matching as close as this is greatly facilitated by the use of an output meter, of course.

Many projectionists depend upon their sound-service engineers to equalize the sound outputs. Professional sound engineers have the experience, knowledge, and equipment to do the best job. But if one projector falls off in output at a time when the engineer is not available, the output of the "louder" projector can be temporarily reduced to match the other by wrapping several turns of clear film around the photocell, holding it in place with rubber bands. Under no circumstances should an exciter be deliberately thrown out of focus to attenuate output: distortion of the sound may result.



The VICOM lens attachment for image compensation

Aufhauser Describes "VIC" Lens At N. Y. Warner Theatre Unveiling

NEW YORK—Fred E. Aufhauser, formerly president of Projection Optics, and now head of the new Vicom, Inc. of Rochester, unveiled the Visual Image Compensator at a trade showing held December 3 at the Warner Theater, here. The "Vic," as the new lens attachment is called, converts regular high-speed 35- and 70-mm prime lenses to wide-angle lenses capable of top-quality results on the largest wide screen. It is claimed that both image definition and depth of focus of the prime lens are preserved by the VIC. Said Aufhauser:

"We anticipate that it will solve the acute problems which you, the projection engineers, had in projecting a large picture with the same qualities we had in the old days with long-focus lenses. But since the advent of large screens and wide-angle projection, we have had to use optics which, at best, are a compromise. The basic requirements for good projection still remain: (1) flat field for a sharp picture from corner to corner, (2) even light distribution on the screen, and (3) depth of focus sufficient to absorb natural buckle of the film due to heat.

"We knew that we had good pictures with quality lenses in focal lengths of 4 inches and up, so we decided that an *optical conversion* of our standard lenses would be a possible solution to this problem. This, then, was the birth of the new Visual Image Compensator, nicknamed 'Vic.'

"VIC optically converts some of our better high-speed lenses into truly wide-angle projection lenses. Not only do we change the magnification ratio by a factor of 2 (which amounts to a *halving* of the focal length of the prime lens —ED.), but we actually improve the optical correction inherent in the prime lens such as flatness of field, resolution, and light distribution.

"By attaching VIC to the prime lens, we maintain the depth of the prime lens which is sufficient to allow for natural buckle, giving us a steadier, sharper, and crisper picture. Longer focus lenses with their larger rear elements allow us to improve light distribution by as much as 200 per cent at the sides, giving, for the first time, even light distribution."

* * *

Rise in 16-mm Bookings

EL PASO, TEXAS — A total audience of more than 1½ million students benefited from the film program of the El Paso Public Schools during the past year, according to the "Audio-Visual Annual Report on Use of 16-mm Films."

New Silicon Tube Developed by Kneisley

Development of a new 15-ampere silicon tube to replace 15-amp. argon-gas and mercury-vapor rectifier tubes in existing rectifiers has been announced by the Kneisley Electric Co., Toledo, Ohio. The Sil-Tube is available in a high-voltage and a low-voltage model catalogued as Types 1170 and 1160, respectively. The following advantages are claimed:

(1) 97 per cent to 98 per cent efficiency, (2) Virtually unlimited life, (3) Hermetic sealing against moisture, (4) Non-aging, (5) No filaments to snarl snag, or snap, (6) Elimination of socket burning, (7) Cooling by convention instead of by fans, (8) Appreciably lower transformer temperature, and (9) Permits uprating of rectifiers, if desired.

The changeover from gas-filled tubes to Sil-Tubes is simple: take out the gas-filled tubes and screw Sil-Tubes into the same sockets. Attach the anode leads to tops of tubes. "Back off" rotary tap switches or voltage taps to compensate for the gain in efficiency, unless more current is desired.

Sil-Tubes are sold under a four-year prorated guarantee, and are available through all theatre-supply dealers.

New High-Speed Color Film Introduced By Eastman Kodak — Has 160 Index

A new, high-speed color motion picture film — fast enough to track a speeding missile and sharp enough to pinpoint almost indistinguishable changes in flame patterns—has been introduced by Eastman Kodak Co.

Eastman Color Reversal Film, Daylight Type, SO-260 made its East Coast debut at the Society of Motion Picture and Television Engineers convention last October, at the Statler-Hilton Hotel, New York. Demonstration reels of the new film were previously shown to missile and defense industry personnel at the 14th Annual Instrumentation-Automation Conference (Sept. 21-25), Chicago.

The new motion picture film has a normal exposure index of 160 (sixteen times as sensitive to light as Kodachrome Movie Film). So sensitive to light is the film that it can capture motion in color under lighting conditions that challenge the highest-speed, black-and-white cine films. (In use for missile data recording, the film has been exposed at indexes up to 500.) Almost as sensitive is the new film's tungsten-balanced (artificial light) companion Eastman Color Reversal Film, Type B, SO-270, which has a normal exposure index of 125.

Suitable for All Uses

The new films' exceptional speed combined with adequate sharpness, moderate grain pattern and excellent color reproduction make them suitable for recording all types of scientific and technical data under unfavorable lighting conditions. Tests have shown that they will be particularly useful in the missile and aircraft industries in missile tracking, flame and aerodynamic studies — especially when data is required concerning color changes. Another probable major application will be in filmed progress reports and in facilities presentations.

Because of the new film's increased sensitivity to light, the colored nose cone of a missile can be easily distinguished against the sky in motion picture footage. In addition, the film's high speed allows photo engineers to take advantage of the superior resolving power of longer focal length lenses (which require smaller lens openings and consequently more light).

Eastman Color Reversal Films can be exposed successfully through high-speed cameras at much higher frame - per - second rates than conventional color materials.

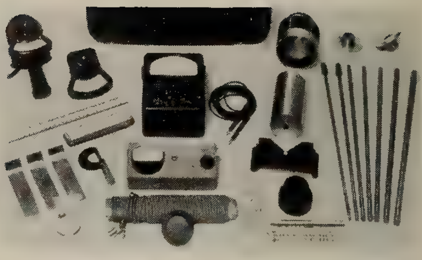
Low Light Levels

As an example of what the higher speed of the new Daylight-balanced SO-260 film means in terms of exposure under low light levels: at a shutter speed of 1/50 second at 24 frames per second sound speed with a lens aperture of f/1.4, the new film may be exposed at the normal 160 rating with only 14 foot-candles of incident illumination.

The introduction of the new films round out the Kodak family of slow, medium and high-speed color motion picture films. Other films are Kodachrome Movie Film and Ektachrome Commercial Film, Type 7255. Kodak points out that the new film is not a substitute for either of these slower, more finely grained films in situations where optimum quality is a prime consideration.

Available in 16-mm and 35-mm

Eastman Color Reversal Film, Daylight Type, SO-260, and Eastman Color Reversal Film Type B, SO-270, are available in 16-mm and 35-mm sizes. These same films are available through Kodak dealers under the names Kodak Color Reversal Film, Daylight Type, SO-260 and Type B, SO-270.



SUITCASE FULL OF SERVICE

Service kit used by National Carbon sales engineers consists of: brightness meter and foot-candle meter; clamp-on ammeter with auxiliary scale; combination voltmeter; and ohmmeter; micrometer; pin-hole apertures and split aperture plates; stopwatch; sliderule, and ruler. Grouped at the right are a dummy lens and set of alignment rods, together with accessory equipment for checking projector lamp alignment.

This has been going on since 1917!

Yes sir, National Carbon Company has provided free screen lighting technical assistance to the industry since 1917. Today, 12 sales engineers—equipped with compact service kits containing the most modern tools in the trade—are ready to assist on any screen lighting problem you might encounter.

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Each salesman's kit contains the following modern equipment: brightness meter, voltohmmeter, clamp-on ammeter, dummy lens, set of alignment rods and accessories, pin-hole apertures, split-plate aperture plates, stop watch, micrometer, ruler and slide rule.

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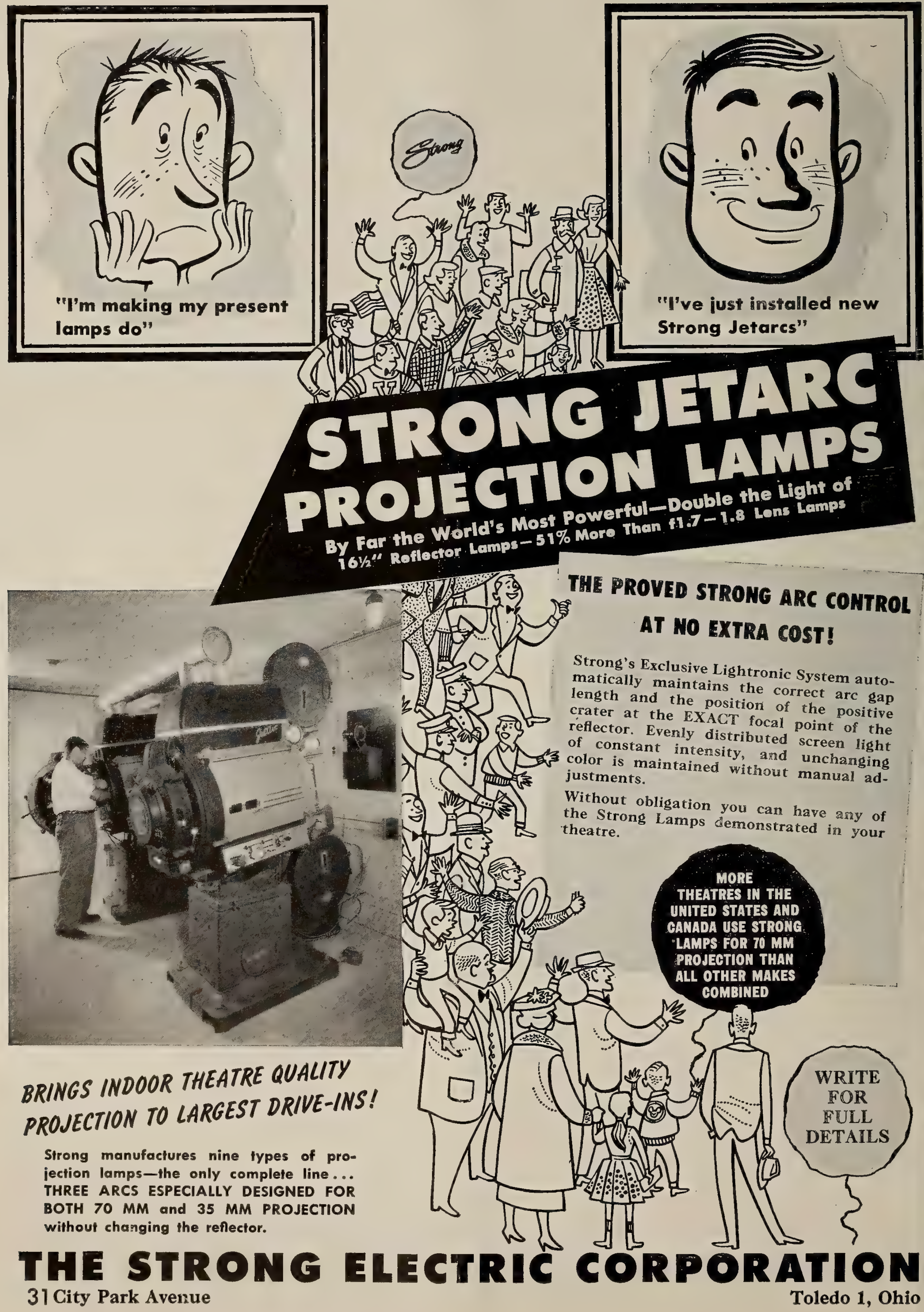
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545 Fifth Avenue
New York 17, N.Y.
RAY GALLO
General Manager

MIDWEST OFFICE
Tenth Floor Upper Midwest Bldg.
Minneapolis 1, Minn.

FRANK W. COOLEY, JR.
Editor and Publisher

R. ENTRACHT
Associate Publisher

RAY GALLO
General Manager

R. A. MITCHELL
Technical Editor

In This Issue . . .

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MONTHLY CHAT

"Art Theatre" Trend Promising

MERE MENTION of the term "art theatre" conjures up many memories for the writer. His first full-time operating job was in a summer art house which featured uncut foreign films interspersed with a generous program of live concerts, opera, and ballet. It was a ritzy operation. The theatre, called a Building of Arts was filled with fresh flowers every day. Jeweled lorgnettes flashed during "curtain teas" at which society caterers served exotic *hors d'oeuvres.* And the screen fairly scintillated with films of classic stature.

Expansion and Prosperity of "Arties"

In those days an art theatre catered only to a small and commercially insignificant minority — the intellectual snobs, the wealthy pretenders to culture, and a few genuine devotees of the off-beat. These audience types are still with us; but the art theatre, in expanding beyond them, has captured an important new patronage of mature movie-lovers. And you and I, as projectionists, may well paraphrase Tiny Tim: "God bless them, every one!"

Things are now "looking up" for theatrical motion pictures; and the growth of the art house — the theatre of films for the discriminating adult — has been stimulated by the sunshine of a new prosperity. Movie attendance is up about 20 per cent over the 1957-1958 slump; and the number of theatres devoted to the mature, artstically good motion pictures has increased by the same percentage.

Now, the art house is a small, intimate-type theatre. Many "neighborhood" grind houses can be, and have been, housecleaned, redecorated, and re-equipped and successfully converted into attractive showplaces for the "little" films which are often superbly entertaining and which the downtown superdreadnaughts and many drive-ins must necessarily pass up.

More, not Larger, Theatres

There are many, many kinds of feature films; and in each category we find excellent productions. The gorgeous, wide-screen spectacular costing millions of dollars may be just as good as an example of its class, as the artistic character study of mood films, and, of course, far more profitable to its producer. But the point I wish to make is that there is ample room and an increasingly insistent public demand for *all kinds* of motion pictures, providing they are *good* motion pictures.

Turning our attention to the "art" film exclusively (an appellative which is not accurately descriptive, by the way), we can envision a resurgence of small theatres on every main street ,byway, and corner. More theatres, rather than larger ones, would be a healthy thing for our industry and a tremendous blessing to the projection craft. Let us speedily have them and an ample supply of films to show in them!

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2	All forms of life, including plants, can develop cancer.	TRUE	FALSE
3	Cancer is not contagious.	TRUE	FALSE
4	More men than women die of cancer.	TRUE	FALSE
5	Pain is a late cancer symptom.	TRUE	FALSE
6	Cancer can strike anyone at any age.	TRUE	FALSE
7	A biopsy (examination of suspected tissue removed from the body) is the only method of proving whether cancer is present.	TRUE	FALSE
8	Surgery or irradiation, or both, are the only means of curing cancer.	TRUE	FALSE
9	An annual health checkup is one of the most effective weapons against cancer.	TRUE	FALSE
10	Over one million Americans are alive today, cured of cancer.	TRUE	FALSE

SCORING: 10: Excellent
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5 or less: Danger! For your own protection, learn more about cancer. Write to "Cancer" —c/o your local post office.

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INTERNATIONAL PROJECTIONIST

Volume 35 February 1960 Number 2

Correcting Distortions In Theatre Projection

By Robert A. Mitchell

Most Theatres Require Violation of Principles of Projection Because of Construction Defects

IT IS AN unfortunate fact that the projection conditions prevailing in most theatres violate the cardinal principles of undistorted optical projection, namely, that all optical elements lie on a straight line (the optical axis), and that the "object" (film) and "image" (screen) be *flat* and *perpendicular to the axis* (O-degree projection angle.

Until the advent of panoramic aspect ratios, motion-picture screens were always flat, fulfilling the first condition mentioned above. But the screen could only rarely be positioned square to the light beam: a downward projection angle has always been unavoidable in most theatres for two important reasons.

First, the image-forming beams of light from the projectors must be high enough to clear the audience. Second, many theatres have one or more balconies which often necessitate placing the projection room absurdly high in the rear of the theatre.

Only in long theatres without balconies is it possible to approach the optimum optical condition for distortionless projection. (Projection angles under 6 or 8 degrees produce no noticeable effects in the picture.) Nevertheless, balconies are extremely valuable to a theatre because of the extra seating area they provide in prime viewing space. Thousands of beautiful and serviceable modern theatres have been designed without balconies, and with a corresponding improvement in projection conditions; but many exhibitors, projectionists, and moviegoers prefer "old-fashioned" theatres which are amply galleried in the classical manner.

Effects of Projection Angle

The existence of more than one balcony level in a theatre practically demands placement of the projection room between the "mezzanine" and the second balcony to avoid the strangely tall, thin images of actors who are known to be more normally proportioned in real life (vertical elongation) and the trapezoidal delineation of rectangular shapes known as the "keystone effect."

Fig. 1 shows what happens to the rectangular shape of a standard Academy aperture projected at an excessive downward angle.

Filing out undersize apertures to compensate for the keystone effect succeeds in producing a rectangular field of light at the screen, enabling the screen to be masked more neatly than otherwise but it cannot eliminate keystoning from the projected pictures.

Keystoning and elongation are too severe to be tolerated when the projection booth is perched somewhere in the stratosphere above the highest of several balconies. Short-focus lenses aggravate keystoning, as do also the wider aspect ratios now in common use. To get an acceptable picture with Todd-AO (70-mm film), it was found necessary to relocate the projection room between balconies in certain large theatres.

Tilted Screens Tabu

In an effort to minimize the bad effects of excessive projection angles, many theatre men have succumbed to a temptation to tilt their screens backward. Although this expedient helps theoretically be reducing actual distortion and by producing a very slight compensating "foreshortening" for viewers in the front orchestra seats, it unfortunately introduces bad effects of its own.

Only in very narrow theatres can backward-tilted screens be used to advantage; and even in favorable

situations the tilt should never exceed 4 or 5 degress from the vertical.

Where wide viewing angles exist, as in most theatres, patrons in the side seats are constantly aware of the tilt of the screen, and it distracts them from complete enjoyment of the pictures. A tilt of only 4 degrees is plainly visible at viewing angles greater than 20 degrees from the center-line of the auditorium; and it is doubtful that so small an angle of tilting appreciably improves the appearance of the picture.

For the great majority of theatres, therefore, tilted screens are highly objectionable and virtually useless. Other means—more unusual but technically feasible—must be pressed into service to eliminate, or at least minimize, the two geometric distortions produced by oblique projection upon flat screens. But before examining these, let's see to what extent various projection angles distort the projected pictures.

Theory of Distortion

If the light-rays focused upon the top and bottom edges of a screen were truly parallel to each other (which they actually are not, for both rays emerged from the same projection lens), the image-elongation effect of oblique projection would be indicated by the *secant* of the projection angle. Now, the secants of angles are "trigonometric functions" found in a table.

As an example, consider "head-on" projection — a 0° projection angle. The secant of 0° is 1, hence the picture-height calculated from the factors of throw lens E.F., and aperture dimensions* is multiplied by 1, which does not change the result. At an angle of 10°, however, the calculated picture-height must be multiplied by the secant of 10°, which is 1.015; at 20° by 1.064; at 30° by 1.155, etc. In brief, the greater the projection angle, the greater the vertical elongation of the projected image.

Under actual projection conditions, however, calculation of the exact height of a picture obliquely involves, not the simple secant of the projection angle, but the secant of all of the following: the projection angle *added* to the square of the lens E.F. divided into the height of the aperture multiplied by the projection angle. A complicated procedure, but no more troublesome than taking a tall stepladder and tape-measure onto the stage and actually measuring the height of the projected aperture image!

Fig. 1—The result on the screen of projecting the conventional 35-mm film aperture "head-on" at 0° and downward at 30°. Note the "keystoning" and vertical elongation of the picture produced by an excessively steep projection angle.

We may dismiss the actual measurement of picture elongation and keystoning with an interesting reflection on the old conventional aspect ratio of 3:4, or, as usually stated nowadays, 1:1.333. This was the aspect ratio of the standard 35-mm silent-film aperture. When the soundtrack took 1/10 inch away from the picture area on the film, the resulting square-shaped aspect ratio was esthetically unpleasant.

The sound-print frame was accordingly reproportioned by the Academy of Motion Picture Arts and Sciences; but instead of conforming strictly to silent-frame proportions, an aspect ratio of

(Continued on page 21)

* Formula for picture height or width, all dimensions in inches: Dimension of picture equal

$$\frac{\text{Projection throw} \times \text{Aperture dimension}}{\text{Lens focal length}}$$

Audio-Visual Convention Set

FAIRFAX, VA.—Harvey W. Marks, Visual Aid Center, Denver, Colo., has been named general convention chairman of the 1960 National Audio-Visual convention at the Morrison Hotel, Chicago, Aug. 6-9, according to an announcement by W. G. Kirtley, president of the National Audio-Visual Association.

The National Audio-Visual Convention features the largest single exhibit of audio-visual equipment and materials in the world. Some 2,500 A-V people, including several groups of A-V users are expected to attend the annual affair this year.

* * *

Kodak Cites Three for Industry Contributions

ROCHESTER, N. Y.— Three photographic scientists in the Kodak Research Laboratories have been named senior research associates, it was announced by Dr. Cyril J. Staud, Kodak vice president in charge of research.

They are Dr. John Spence, Nicholas H. Groet, and Forrest Richey. The title of senior research associate is reserved for those who have made significant contributions over a period of years to the work of the laboratories.

Dr. Spence has been with the Kodak Research Laboratories for 25 years. He first joined the laboratories as a physical chemist in the chemistry department, becoming a departmental supervisor in 1938. He transferred in 1940 to the emulsion research division.

He has made noteworthy contributions to both theory and practice in the field of optical sensitizing of photographic emulsions and is the author of a number of publications in this area. He has also been responsible for many years for the development and manufacture of photographic film and plates supplied by the research laboratories for use in scientific and technical fields.

Groet joined the physics division of the research laboratories in 1934. He transferred in 1938 to the color photography division. He was named a research associate in 1952.

Groet assisted in the development of color film for use in aerial photography by the armed forces early in World War II. Since then he has played an important role in the development of Ektachrome and Kodacolor films and processes.

He is a fellow of the Society of Motion Picture and Television Engineers and is the co-author of several technical articles on color films.

Richey was a member of the motion picture film processing department at Kodak Park from 1939 to 1944, when he transferred to the color photography division of the research laboratories. He was named a research associate in 1950.

His research and development work has been an important factor in evolving and improving amateur, professional, and commercial motion picture color films. He has also been concerned with the development of methods for processing Kodachrome and other color films. He is the author of several technical papers on color photography.

Richey is a member of the Society of Motion Picture and Television Engineers, and of Tau Beta Pi honorary engineering fraternity and Phi Lambda Upsilon honorary chemical fraternity. He was graduated from Iowa State College with a B.S. degree.

BUSINESS NOTES

• Arthur Hatch, president of the Strong Electric Corp., Toledo, has announced the election of Leo T. Nelson as treasurer. With the Strong Electric Corp., since 1929, Mr. Nelson served as assistant treasurer. He replaces Ralph N. Harder, New York, who is retiring. Strong Electric manufactures projection arc lamps, rectifiers, reflectors, arc and mazda spotlights, printing and camera arc lamps for the graphic arts field, solar furnaces, arc imager furnaces and arc slide projectors.

• Four appointments at the Kodak Park Works plant of Eastman Kodak Co. have been announced by Clarence L. A. Wynd, plant general manager and a company vicepresident. Dr. Lester C. Faulkenberry has been named an assistant general manager of the Kodak Park Works. John G. Mulder has been appointed administrative assistant to the Kodak Park general manager, succeeding Dr. Faulkenberry. Dr. Richard F. Miller has been named director of the film services division, succeeding Mulder. J. Paul Gocker has been appointed assistant director of the division, the post formerly held by Dr. Miller.

Kodak Park in Rochester, N.Y., is the largest manufacturing unit of Eastman, it employs over 20,000 people in the manufacture of photographic films, papers, and chemicals.

• Joseph M. Kees has been named to the new post of manager, Los Angeles regional office, according to Robert Tate, director, sales and service division of General Precision Laboratory. Mr. Keys will be in charge of all sales and service activities of the GPL facility at 180 N. Vinedo Ave. in Pasadena.

• Newton B. Green, Eastman Kodak vicepresident and general manager of the company's Aparatus and Optical (A&O) division, retired Jan. 1. He has been with Kodak for 41 years. Herman H. Waggershauser was appointed to succeed Green as general manager of the A&O Division and he also was elected a Kodak vicepresident by the board of directors. Waggershauser has been assistant general manager of the A&O Division for the past two years and has been with the company since 1933. The division includes three plants in Rochester which manufacture cameras, projectors, other photographic and optical equipment, and special military products.

• Anthony L. Conrad has been appointed president of the RCA Service Company, it was announced by C. M. Odorizzi, group executive vice president, Radio Corporation of America.

Joining the RCA Service Co. in 1946, Mr. Conrad first served as manager of the company's television service branch at Albany, N. Y., moving to the home office in 1947 to serve in various managerial and technical capacities, including posts as manager of technical employment, systems engineering, and government technical operations. In 1953 he received the RCA Victor Award of Merit for distinguished service in the field of guided missiles.

• The appointment of John A. Hawthorne to the new post of manager, industrial distribution has been announced by N. M. Marshall, associate director, industrial products, General Precision Laboratory Incorporated, Pleasantville, N. Y. GPL, a subsidiary of General Precision Equipment Corp., designs, develops and manufactures industrial and broadcast television equipment and communications equipment.

* * *

J. H. Moore Heads Sacramento Local

SACRAMENTO, CALIF. — J. H. (Francis) Moore has been elected president of the Moving Picture Machine Operators Local 252, IATSE here, according to an announcement by L. E. (Les) McMillin, elected recording secretary. William L. O'Kelly is vice president, Fred Luckan financial secretary, Joe Apathy treasurer, W. R. Federolf, business representative, and Wayne Mitchell sergeant-at-arms.

On the executive board are F. A. Ornbaun, Robert Swilling, and Robert McNulty. Trustees are I. Duval, Mario Menconi, and Thomas Dunn, with Messrs. Moore and Federolf as delegates to the Sacramento Central Labor Council. Messrs. Luckan, Dunn and McNulty are pension fund trustees.

* * *

Conference Set On Educational TV

BLOOMINGTON, IND.—Airborne television will receive major attention during a Conference and Workshop in Educational Media to be held at Indiana University, June 27-July 1, 1960.

Devoted mainly to the utilization of television for educational purposes, some time will be spent on open-circuit and closed-circuit television ,and other types of instructional materials.

Lectures, demonstrations, and group discussions will deal with such specific aspects of airborne educational television as (1) plans and possibilities, (2) the nature and role of the medium as an instructional resource, (3) classroom application, (4) program information, and (5) demonstrations of actual educational uses.

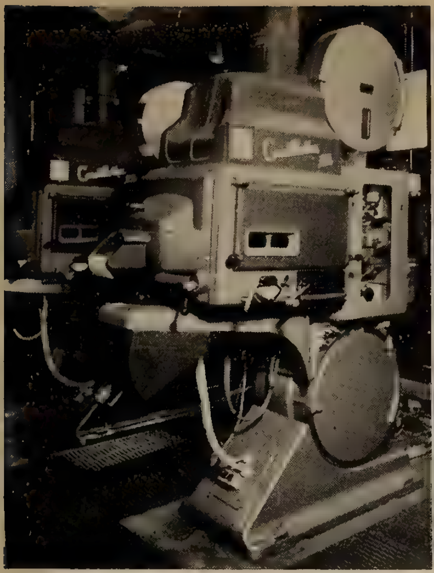
The Conference and Workshop are designed for principals, supervisors, classroom teachers, co-ordinators of educational media, and those leaders who have responsibility in connection with the use of audio-visual materials, including school board members, PTA members, and staff members of state departments of public instruction.

* * *

1,000-RUN PRINTS

Twin records for the number of runs made with a single 70-mm print were recently set by two theatres in the United Kingdom. Both the Dominion Theatre in London and the Gaumont in Manchaster have topped the 1,000-run mark with their very first print of "South Pacific."

The original prints are still in excellent condition and regular performances continue with them, using Norelco (Philips/Todd-AO) 70/35-mm equipment, according to Niels Tuxen, manager, of its motion piceure equipment division, and Martin Sweeny. North American Philips Co. Inc., is manufacturer and supplier of the Norelco Universal projector for the U.S. Mr. Sweeny is with Todd-AO Corp., with distributes the equipment.



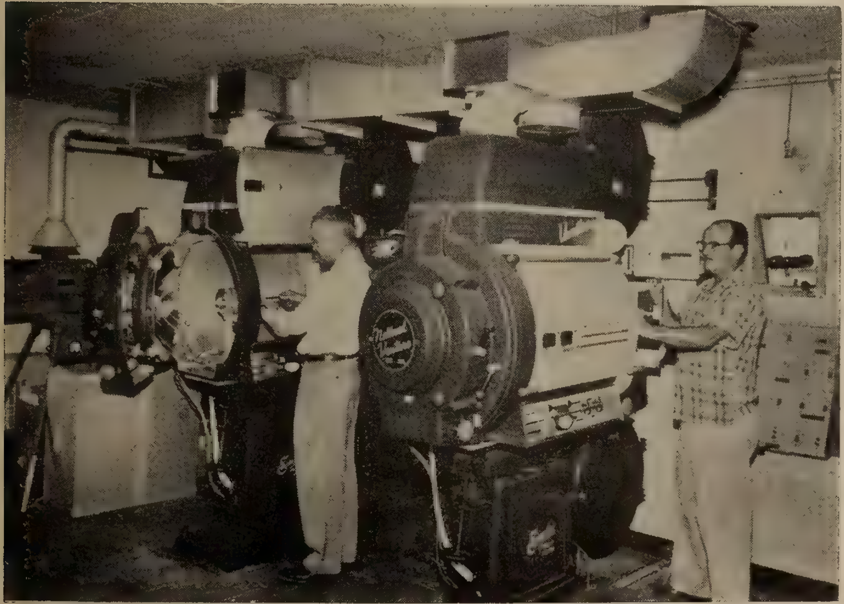
PACIFIC DRIVE-IN THEATRE
San Diego, Calif.
Constellation on Simplex

ST. LOUIS PARK THEATRE
Minneapolis, Minn.
Constellation 170 on Century

TOWN THEATRE
Baltimore, Md.
Constellation on Bauer

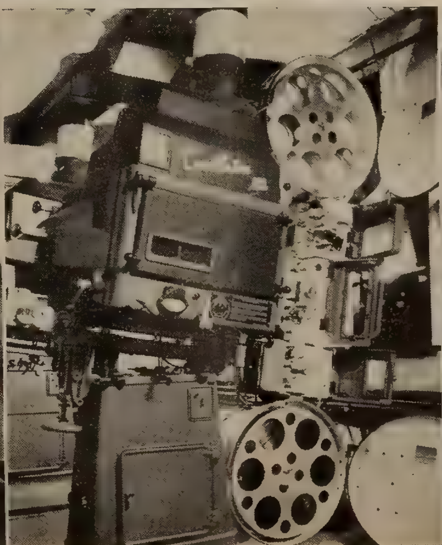
Theatre Modernization . . .

National Theatre Supply Pictures New Installations

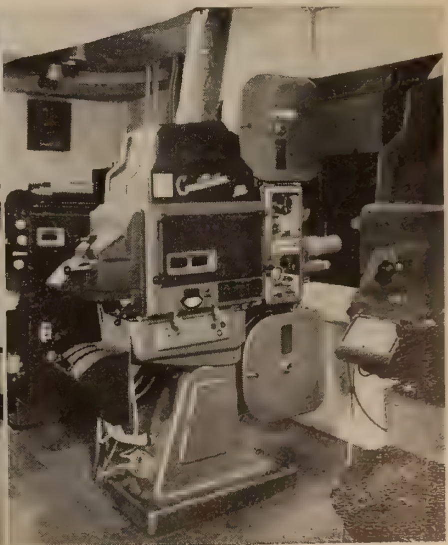


MIDWAY THEATRE
San Diego, Calif.
Ventarc on Simplex X-L

A Constellation
Norelco
Installation



STRAND THEATRE
Lexington, Ky.
Constellation on Norelco



MONROE THEATRE
Rochester, N.Y.
Constellation on Norelco

Standard Filmstrip Specifications Ready

FAIRFAX, VA.—A set of standard specifications for 35-mm single frame filmstrips has been released by the filmstrip standards committee of the National Audio Visual Assn. The new specifications cover such technical items as length of leader, marking of start and end leader, and frame size.

The new specifications are being submitted to the American Standards Assn. in the hope that they will eventually be accepted as a revised American standard for filmstrips. Pending such official action, however, a number of leading producers of filmstrips have indicated they plan to proceed immediately to follow the standard specifications.

Copies of the Standard Specifications are available to filmstrip producers, equipment manufacturers and other interested companies from the National Audio-Visual Assn., Box 337, Fairfax, Va.

Eastman Kodak Budgets $67 Million in 1960

ROCHESTER—The Eastman Kodak Co. plans to invest about $67 million in company improvements during 1960, it was announced by Thomas J. Hargrave, chairman, and Albert K. Chapman, president.

The amount is Kodak's largest budget for additions, replacements, and improvements in its U.S. facilities.

About $32 million of the 1960 expenditures is budgeted for facilities in Rochester, including the Kodak Park Works, where photographic films, papers and chemicals are made; the Apparatus and Optical Division, which makes cameras, projectors, other photographic and optical equipment, and special military products; and administrative headquarters of the company.

* * *

Named Director

NEW YORK—Fred B. O'Mara has been named director of manufacturing for National Carbon Co., division of Union Carbide Corp., it was announced by Wm. H. Feathers, president.

Mr. O'Mara will be located at National Carbon production headquarters in Cleveland, and will be responsible for all manufacturing operations at company plants in Cleveland and Fostoria, Ohio; Clarksburg, W. Va.; Columbia and Lawrenceburg, Tenn.; and three plants in Niagara Falls, N. Y.

Mr. O'Mara joined National Carbon Co. in 1936 following graduation from Purdue University, where he majored in metallurgy. He served in the production organization until 1944 when he became associated with the marketing department. His most recent assignment was as marketing manager of electrode products.

In his position as director of manufacturing, Mr. O'Mara succeeds H. T. Reid, who will report directly to Mr. Feathers in coordinating the engineering aspects of the company's long range planning program.

* * *

Leo White Dies

LEO B. WHITE, a member of Local 173, IATSE, Toronto Motion Picture Projectionists, for 50 years, died in retirement at a rest home Jan. 5, after a brief illness.

45th Convention of IATSE Scheduled for Chicago in August

NEW YORK—The 45th convention of the International Alliance of Theatrical Stage Employes and Moving Picture Machine Operators will be held at the Conrad Hilton Hotel, Chicago, Ill., beginning on Monday, Aug. 1, 1960, it was announced by Richard F. Walsh, International president.

At the same time announcement was made that the mid-winter meeting of the I.A.T.S.E. general executive board will be held at the Multnomah Hotel, Portland, Ore., beginning on Monday, March 21, 1960.

* * *

Fred E. Boekhout Elected President of Rochester Local 253

ROCHESTER, N. Y.—Fred E. Boekhout has been elected president of Local 253 IATSE, assisted by Louis Levin as vice president. Frank E. Coniglio is business agent, Frank J. Placerean, financial secretary and treasurer and Walter A. Knopf recording and corresponding secretary. Alfred J. Hill is sergeant-at-arms.

The executive board is composed of Robert Cragg, Louis Goler, Joseph Pandina and Fred Closser.

* * *

J. P. McGuire Heads Ottawa Local 257

OTTAWA, ONT.—J. P. McGuire has been elected president of the Ottawa Motion Picture Projectionists' Union, Local 257. IATSE, according to a recent announcement by W. Murray Hall, secretary-treasurer.

J. H. Hewson was elected vice president, J. P. Harris, business manager and W. K. Austin sergeant-at-arms. Trustees are G. Gravelle, P. H. Morre and T. Cardo.

* * *

ON TOUR

NEW YORK—Frank E. Cahill, Jr., vice president in charge of sales for Century Projector Corp., attended the convention of the Texas Drive-In Theatre Owners Assn. in Dallas, Feb. 9-11, then went on to Los Angeles.

Exports of Motion Picture Film Decline

WASHINGTON — Exports of motion picture film and equipment from the United States in 1959 were valued at $43,159,642, slightly lower than 1958 exports valued at $32,411,016 according to statistics released by Nathan D. Golden, director, scientific, motion picture and photographic products division, business and defense services administration, U. S. Department of Commerce.

The compilation made from preliminary figures of the Bureau of the Census revealed that while there was a notable drop in exports of motion picture equipment, this was offset by much larger expart of 8-mm. and 16-mm. unexposed motion picture film (rawstock). Increases were also registered in exports of 8-mm. and 16-mm. motion picture projectors.

Exports of unexposed motion picture film (rawstock) in 1959 amounted to 696,475,281 linear feet valued at $17,677,101, more than 108,000,000 feet higher than 1958 exports of 587,923,255 linear feet valued at $16,330,845, with the increase being accounted for by much higher exports of 8-mm. and 16-mm. films. Exports of exposed motion picture feature films both 35-mm. and 16-mm., totaled 282, 328,140 linear feet valued at $10, 855,994 in 1959, about 40,000,000 linear feet below 1958 exports of 321,856,505 linear feet valued at $11,592,907.

Total exports of all types of motion picture equipment, including cameras projection and sound equipment ,and studio equipment, during 1959 amounted to $14,626, 547 about 5% below 1958 exports valued at $15,487,264.

* * *

Magnetic Recording

REDWOOD CITY, CALIF— Magnetic recording continues to offer the most lasting, efficient, economical and practical method for recording and reproduction of television pictures and other data, George I. Long, Jr., President of Ampex Corp., has declared.

Commenting on an announcement concerning research and development work on thermoplastic recording process, Mr. Long stated that "when improved techniques become economically practical, they will be incorporated in our product line."

An Analysis of Various Methods for Minimizing Aperture Heat in Projection

HAROLD H. SCHROEDER

Research and Engineering Division
Bausch & Lomb Optical Company
Rochester, N.Y.

The interference-type "cold mirror" is the latest and most effective weapon in the battle against excessive heating of the film in the projector aperture. Improvements in the stability and heat-reducing efficiency of dichroic mirror coatings have made the Bausch & Lomb BalCOLD reflector a necessary item for good projection in all installations where arc currents exceed 100 amperes. In this article the author discusses the practicability of heat-reducing filters used in conjunction with dichroic mirrors.

THERE have been a number of methods proposed within recent years for minimizing heat at the aperture in 35-mm projection systems.

One of the first of the modern methods was to utilize the dichroic heat reflecting filter of the insertion type consisting of a vacuum deposited multilayer coating applied to a quartz or pyrex carrier. This system afforded a heat reduction of approximately 30 per cent ad resulted in a light loss of about 10 per cent.

While it was an improvement over heat absorbing glass or water cells with heat absorbing aqueous solutions from a mechanical and visual efficiency standpoint, the filter was recognized as not having anywhere near the optimum heat removing properties.

Also, as is the case with any type of insertion filter, the heat reflecting filter is subjected to very high local temperatures which can, in effect, literally burn the coating from the quartz or pyrex.

As a device which would provide greater heat reduction, the "Cold Reflector" was the next logical step. This reflector has the property of transmitting infrared radiation while reflecting the visible energy. It is simply substituted for the silver reflector. The interference coatings are vacuum deposited on the outer or convex surface of the glass reflector blank. The "cold" coating is protected from environmental conditions and from handling by a heat resistant silicone material which is sprayed on. With the coating on the rear surface, the reflector can be cleaned in the same manner as the projectionist has been accustomed to doing in the past.

With the advent of the cold reflector, the heat-reflecting type of coating seemed of less interest, i.e., it was not at first used in conjunction with the cold mirror. The cold reflector reduces the heat at the aperture by about 45 per cent and delivers, on an average, 95 per cent of the light furnished by the silver reflector. In many cases, the cold reflector delivers more light than the silver mirror. After surviving a period of troubles with durability, which led to process modification and improvements, the cold refleflector is now being well received, and is in use in excess of 1,000 theatres over the country.

One of the latest systems to come to the fore is a device which makes use of a combination heat filter and water cell filled with distilled water. The water cell is surrounded by a glass jacket which provides for water circulation. A dichroic heat reflecting coating is applied to the surface of the water jacket nearest the arc. This system reduces the heat by approximately 45 per cent, the same as the cold reflector, with a light reduction of about 12 per cent.

This system is mechanically more complicated than the cold mirror and is less convenient to install and use, since a water circulation system is required. The dichroic coating on the jacket is of more complicated design, etc. It is kept cool by the circulating water and is not apt to be burned off by the concentrated arc, unless there is a failure of the circulating system, in which case there is a likelihood of serious damage to all lamphouse components.

This system has seen limited use in trial installations on the West Coast, and has worked well optically, but has met with some mechanical failures.

The last system to be discussed is one which has found limited use in applications where the heat

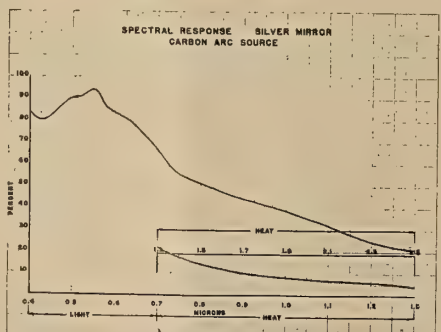


FIGURE 1

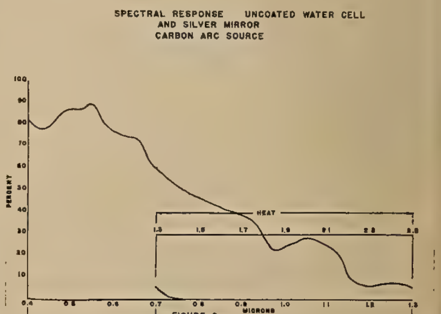


FIGURE 2

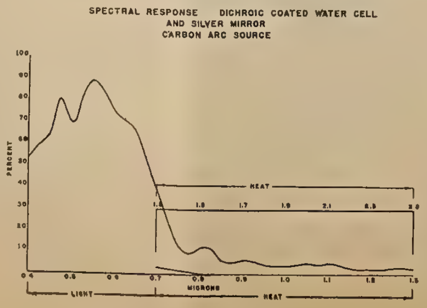


FIGURE 3

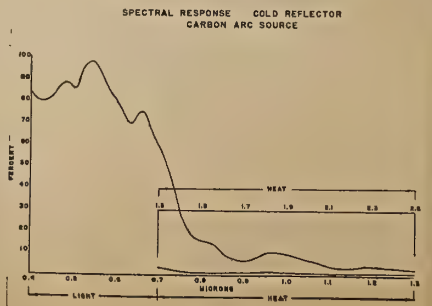


FIGURE 4

System	% Light	% Heat	Heat Reduction %
Silver Mirror	100	100	0
Water Cell	100	92	8
Water Cell with Modified Dichroic Heat Filter	100	57.8	42.2
Cold Reflector	100	58.5	41.5
Cold Reflector with Conventional Dichroic Heat Filter	100	51.5	48.5

problem is particularly severe. In this setup, the conventional heat filter is used in conjunction with the cold reflector. This system results in a heat reduction of 50 per cent, while reducing the light by 10 per cent. The heat reducing action of the cold reflector furnishes thermal protection for the heat reflecting dichroic. In a few installations on the East Coast, this has proved to be very successful.

In summing up, we have tabulated the accompanying data for the various systems. All systems

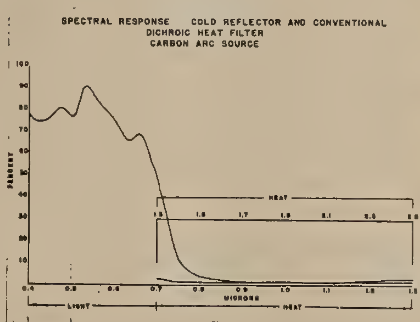
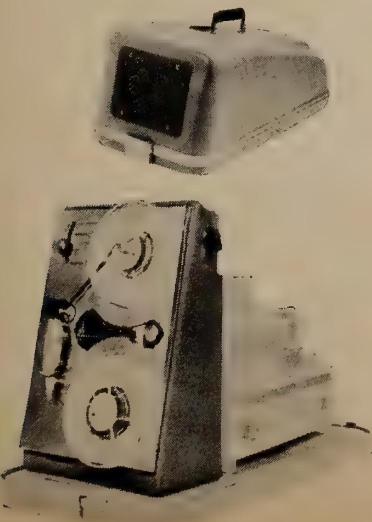


FIGURE 8

are equated to equal useful screen illumination levels.

Synchro-Mat Is Audio-Visual Aid

The DonnLu Siegel Corp. of Jackson, Mich., has announced a new audio-visual unit in the Synchro-Mat line. The new unit, designated as the Model 'C' Synchro-Mat, provides the "unlimited" advantages of combining the recorded word with the projected image, 'automatically,' in a new compact, lightweight unit.



The new Model C Synchro-Mat functions with the simplicity of a standard tape recorder but with a minimum of complex controls. Utilizing the dependability of an electronic dual track system, any remote controlled slide or filmstrip projector, or projection equipment can be synchronized to split second timing at the touch of a button.

To program any presentation, make a regular recording, touch the button when a slide change is desired. The tape can then be played back as few or as many times as required with the slides changing in perfect synchronization automatically. Housed in a new Royalite case for maximum strength and lightweight portability, the Model C Synchro-Mat raises into operating position providing a convenient platform for the projector. The unit features a built in speaker in the lift-off case, the company states.

The Model C Synchro-Mat uses up to 7 in. reels of standard magnetic recording tape with operating speeds of 3¾ and 7½ IPS. Several types of cartridges are available for continuous operation. The unit features the exclusive piggy-back, completely transistorized circuit.

The Model C Synchro-Mat is available in two models: The record/playback and the playback-only model. For additional information, contact the Sales Dept., DonnLu Siegal Corp., Jackson, Mich.

Rear-Projection Screens: A Neglected A-V Aid

TEXTBOOKS OF AUDIOVISUAL techniques and equipment accord to rear-projection screens only the scantiest mention. This seems strange to us. considering the utility of rear projection in television studios, shop windows, and other locations where it is desirable to produce a brilliant, attention-arresting projected image under conditions of high ambient illumination. Let's look into the matter.

Your local TV announcer, for example, is able to clarify news and advertising slides by standing in front of a large rear-projection screen and pointing to the pictorial details he wishes to bring to your attention. The announcer, himself, is not hidden in darkness: his face and expressions can be seen as well as the projected photo or art material because modern rear-projection screens do not require darkened rooms. What a marvelous instructional aid for the teacher who want to *teach* from slides and films, and not merely present them as a passive visual experience!

Picture Visibility

True, the technique of picture projection on translucent screens is very different from projection on ordinary white, beaded, or aluminized reflective-type screens, all of whcih require a darkened room. It pays to become acquainted with the requirements of successful rear projection because it offers tremendous advantage for numerous classroom purposes.

Space Saver

In order to shorten the distance between the projector and the screen in rear projection, use lenses of short focal length. For example, the standard lens furnished with 16-mm projectors has a focus of 2 inches. Use a 1-inch lens to get the same size of picture at half the distance! Also obtain "half-length" lenses for all the slide and filmstrip projectors for rear-projection purposes.

Projection upon ordinary screens is accomplished by setting up the projector (slide, opaque, filmstrip, or movie) *in front* of the screen, and usually well behind the audience. The room must be reasonably dark because ambient light reduces picture-contrast by "washing out" detail in the darker areas of the image. *Picture visibility is primarily a matter of contrast,* i.e. *the scale of relative brightness existing between the deepest shadows in a picture and the brightest highlights.* With no contrast there is no picture.

Rear-Projection Technique

To project upon a translucent screen, the projector is set up *behind* the screen — but this is not the only requirement. There are two other conditions which must be met in order to get a "snappy," brilliant picture having normal left-to-right orientation.

1. The audience (class) area may be brightly lighted as you may wish to have it when rear projection is used, but the area behind the screen, where the projector is located, must be kept as dark as possible. Keep in mind that the light seen on a translucent screen is light *which has passed through it* from behind. Nevertheless, it is only common sense to avoid setting up a rear-projection screen where extremely bright light, such as direct sunlight, strikes its front surface. In other words, treat a rear-projection screen as though it were the picture-tube of a TV set.

The "dark back area" requirement may be met in several ways. One stratagem is to set up the projector in the darkest corner of the room — a corner preferably fitted with black drapes to make the walls darker. Another method is to enclose the narrow projector-to-screen area with black folding screens of the kind used in dressing rooms. These will help keep the back surface of the screen dark.

Yet another method — and the most convenient of all when a "TV-bright" picture of small or moderate size is desired in a fully iluminated classroom — is the use of lightweight, ready-made "rear-projection box." More about this handy item anon.

2. Because the left-to-right relationship is reversed on the "viewing side" of a translucent screen, the slide or film must be turned around left-to-right in the projector. This poses no difficulties in slide, filmstrip, and silent-movie projection, but sound film cannot be reversed in the projector because the soundtrack must always be on the correct side. To show sound movies on a rear-projection screen therefore the projector must either be fitted with a reversing prism or aimed at a flat plate-glass mirror which both reverses the image and redirects it to the screen.

"Rear-Projection Boxes"

Commercial rear-projection boxes some of which are made to fold up flat when not in use not only have a frame to support the screen material but also a flat mirror inside the image. The projector is accordingly aimed, not at a screen, but at the mirror, a condition permitting convenient placement of the projector at the side of the box. Both slides and films are placed in the projectors in the normal manner when such a rear-projection box is used.

Among the most widely used rear-projection boxes we find the Polacoat Lenscreen Models 225 (15" x 15"), 432 (18" x 24"), and 625 (25" x 25"); the Strobel-Vision Universal 216 (15" x 19½"); the superb Burleigh-Cashman B-C-Scope Models S (15" x 22") and L (22" x 30"); and the completely portable MK Models IV (9" x 12") and V 13½" x 18") manufactured by

the Television Associates of Indiana.

It goes without saying that certain brands of translucent screen are better than others. A mere frosted glass or etched plastic will not do, as such a screen reflects too much of the room light back into the eyes of the viewers and appears whitish even when enclosed in a light-tight, black-painted rear-projection box. The screen should actually appear dark gray or black until the projector is switched on to illuminate it from the back. Moreovor, the rear - projection screen must diffuse the projection light sufficiently to give a bright-looking picture over wide viewing angles without a "hot spot" in the middle.

There are many good vinyl plastic rear-projection screens available. These may be purchased by the square foot or ready-mounted in wood or metal frames supported by tripods. Sizes vary from 12 inches to 12 feet and more in width. Among the different brands of proven quality are Even-Vu, Solarbrite, Trans-Lux, and Lenscreen.

The Polacoat Lenscreen deserves special mention because it is available in several forms: glass, plexiglas, rigid and flexible vinyl, etc. Each of these transparent "support materials" is coated with a special optical stratum which functions like an array of microscopic lenses, assuring the best rear-projection performance attainable *regardless of front-lighting conditions.*

TV-like "Immediacy"

The effectiveness of a judiciously used rear-projection box in the classroom approaches, and sometimes equals the peculiar and gratifying "immediacy" of television. The translucent screen provides the only way known, short of TV, for showing slides and films in a fully lighted classroom with the pupils seated *directly in front of the screen.* And rear-projection images are bright, sharp, and vivid, imparting new life and instructional potency to projection materials which may seem dull and remote on a large reflective-type screen in a dark room.

A more technical discussion of rear-projection screens will be presented in a future issue of IP if there is sufficient demand for such an article.

The Projection Alignment Tool Kit

Projector Alignment Kit Available From Research Council

HOLLYWOOD—The Motion Picture Research Council, from experience gathered in contacting theatres during the theatre liaison program and due to further efforts in its laboratories, has developed a new set of tools for projector alignment which is now available in kit form, directly from the Motion Picture Research Council. This kit contains two new tools which will aid projectionists in lining up their projectors, and improve the light efficiency and picture quality of motion pictures as presented in theatres.

This new Projection Alignment Tool Kit contains:

1) A film path gauge to mechanically line up the fixed guide roller, the guide rails, and the narrow-tooth intermittent sprocket.
2) An optical alignment tool to position the carbon arc and the mirror on the optical axis of the projection lens.
3) Sufficient footage of 35mm all purpose projector alignment film to make from two to three loops depending on the type of projector. This film is used in conjunction with the alignment tool to center the image on the film on the optical axis.

Instructions for the proper use of these tools in the alignment kit are enclosed with each order. The tool kit and its shipping container are shown in the photo. In brief, the above listed items serve the following purpose.

The film path gauge, in the foreground of the photo, is a precision tool to mechanically align the fixed guide roller, the guide rails, and the teeth of the intermittent sprocket, and can be inserted in the aperture of any projector having narrow teeth intermittent sprockets. If the tool has been properly used, the entire film path is perfectly aligned mechanically and no cupping of film or damage to perforations will result. This results in better focus, steadier pictures and longer release print life.

The optional alignment tool also shown in the photo, is used to align the illumination system with the optical axis of the lens, and together with the projector alignment film allows the proper orientation of the projector with the center of the screen. One of the outstanding features of this tool is that it can be used with the projector in full operation, that is, the arc burning, the dowser open, and the projector running. The tool is inserted in the projector in place of the lens. Since an adjustable observation mirror is provided with the alignment tool ,all alignment operations can be made from the projectionist's usual working position.

When the checking of the projector with the optical alignment tool has been completed and the projector threaded with the alignment film, as also supplied in the kit, the tool can be removed from the projector and the lens inserted. Since the line up film has vernier scales on the top and bottom as well as both sides of its target, it is now possible to center both the film and projector accurately

Continued on Page 19

LETTERS TO THE EDITOR

Controlling Volume

Editor of IP:

I have just finished reading your article "ACOUSTICS, SPEAKERS and VOLUME CONTROLS" and I must say you hit the nail on the head in regards to controlling volume.

Would you furnish me with a schematic as to how I would hookup a remote volume control downstairs from the projection room so we can control the volume from there?

We are using a Century W5-11 amplifier.

I am inclosing a self-addressed envelope and a schematic for your reply.

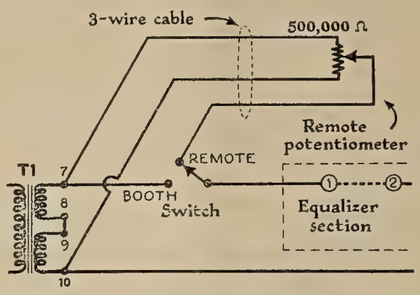
RAY S. HANSON
Galt, California
January 4, 1960

Dear Mr. Hanson:

Thank you for your appreciative words anent my December IP article. Although many projectionists seem to be dead set against allowing an "outsider" to control the sound volume, I believe that use of this method would soon convince them that a competent observer in the auditorium is in a better position to control volume than anyone else.

The best arrangement for a remote volume control is the one presented in the Monthly Chat in IP for August, 1959. However, the sound system you have employs two ganged potentiometers connected to the preamplifier outputs. This would make the suggested arrangement difficult to carry out without disturbing system balance unless the system is rewired so that both preamplifiers feed into a single potentiometer. This is a job for a sound service engineer who has available the units and recommendations supplied by the manufacturer of your equipment.

An easier, although perhaps less satisfactory, way would be to parallel the remote-control potentiometer to the secondary of the main amplifier input transformer (T1), connecting the two outside potentiometer leads to terminals 7 to 10, as shown in the accompanying schematic.



The wire which connects terminal 7 to the equalizer section of the W5-11 amplifer is cut, and a single-pole double-throw switch inserted as shown, with the center lead from the remote-control potentiometer connected to one of the outside terminals of the switch.

In one position, this switch disconnects the remote-control potentiometer from the amplifier and permits volume control from the booth in the usual way. In the other position, the remote control is operative. But to use this control, the volume control in the booth should be turned up quite far, as the sound current still goes through the booth volume control.

Note that the 500,000-ohm resistor of the potentiometer remains connected across the secondary of the input transformer at all times. This constant "load" prevents a change in the frequency-response of the system when the remote control is switched on. If use of this hookup attenuates the higher frequencies slightly ("muffles" the sound), a suitable corrective adjustment can be made in the equalizer section per the manufacturer's instructions.

Heyer-Shultz Revises Some Reflector Prices

CEDAR GROVE, N. J.—Heyer-Shultz, Inc., has announced changes in policy and list prices as well as product additions. The first price revision since 1953, some reflectors are up slightly, with others holding the same level.

Models 1000 to 1434 rhodium finished reflectors show a rise in price of less than 10 per cent.

Models 1500 to 1650 rhodium finished reflectors remain at the present price level.

The price on the Heyer-Shultz aluminized, high efficiency reflector has been reduced in all models listed, as has the guarantee period. This reflector will now be guaranteed one year.

Experience with the aluminized reflective finish during the past 7 years has indicated that, under conditions generally prevailing in the average projection room this item will not stand up consistently for a 5-year guarantee period. The resultant breakdowns have been a source of irritation to all concerned, even though refinished at no charge and/or replaced on the pro-rata basis.

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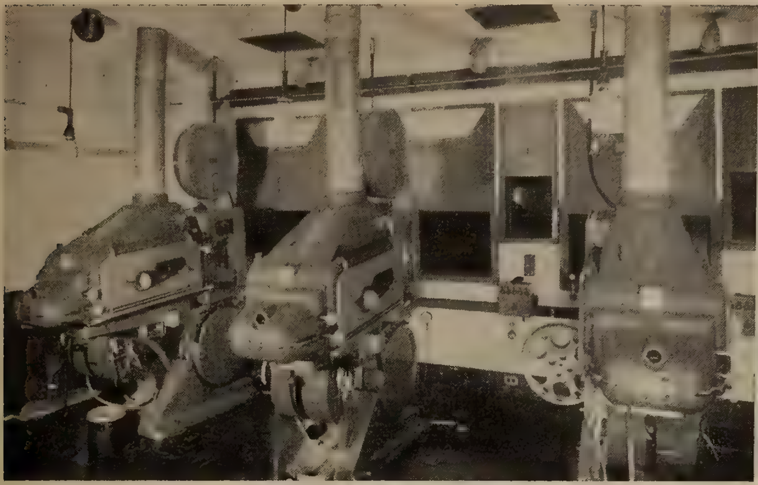
Viewlex Holiday

LONG ISLAND CITY, N. Y.—Viewlex, Inc., the world's largest exclusive manufacturer of 35-mm filmstrip and slide projectors, is sponsoring a contest that offers the winning teacher a free round-trip to Europe for two via TWA Boeing 707 Jet.

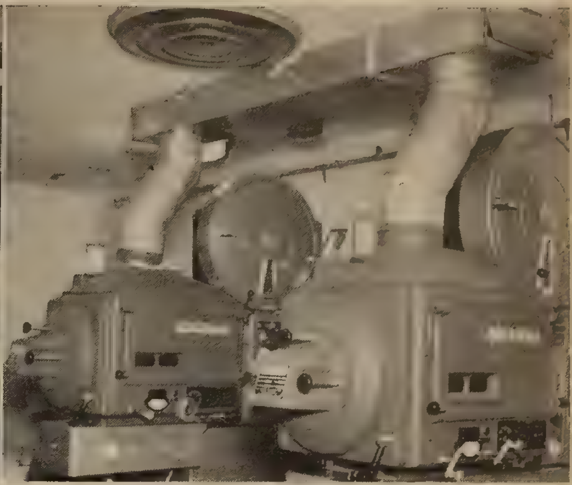
The free European holiday will be given to the teacher who submits the best report or essay on "How Audio-Visual Aids Make Teaching And Learning Easier." Teachers are asked to write, in as many words as they choose, reports that may be based on their everyday teaching activities in working with Viewlex projectors and other A-V equipment.

Entry applications, rules and all contest information, can be had from the Viewlex Company, Inc., 35-01 Queens Blvd., Long Island City 1, New York.

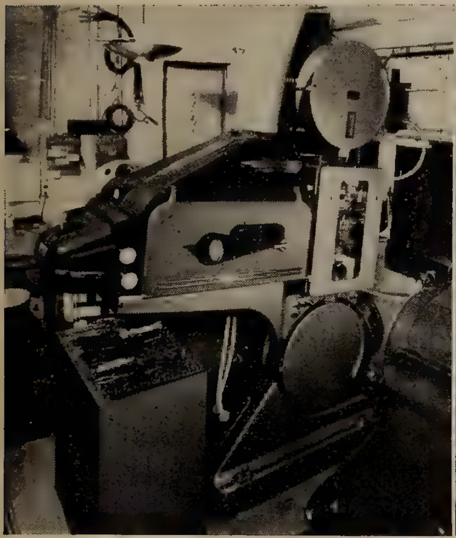
Strong Electric Corp. Shows New Lamp Installations



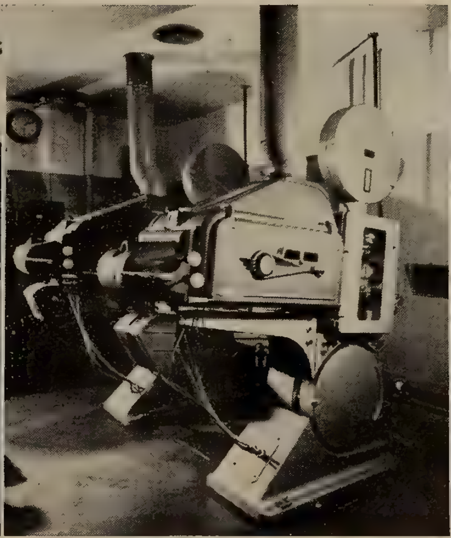
MCVICKERS THEATRE
Chicago, Ill.
Hycandescent on Norelco



TOWN AND COUNTRY THEATRE
Jacksonville, Fla.
35/70 On Victoria X



CAPRI THEATRE
San Diego, Calif.
Hycandescent on Norelco



STATE THEATRE
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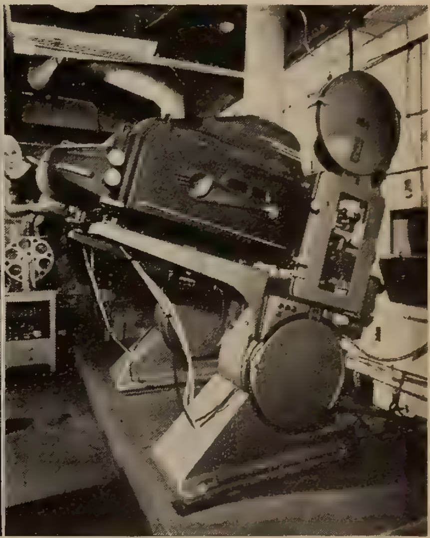

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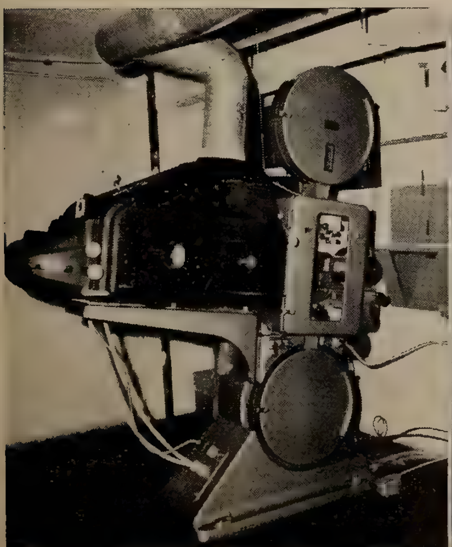

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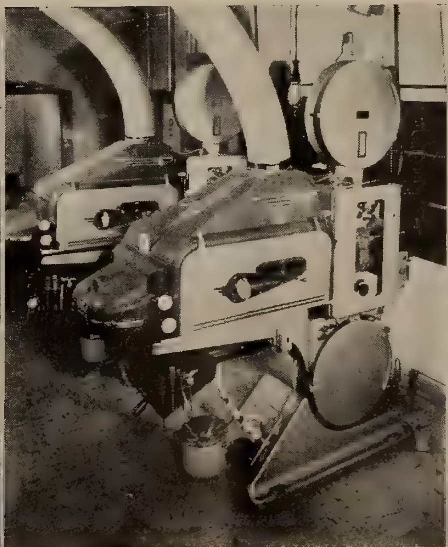

UNITED ARTISTS THEATRE
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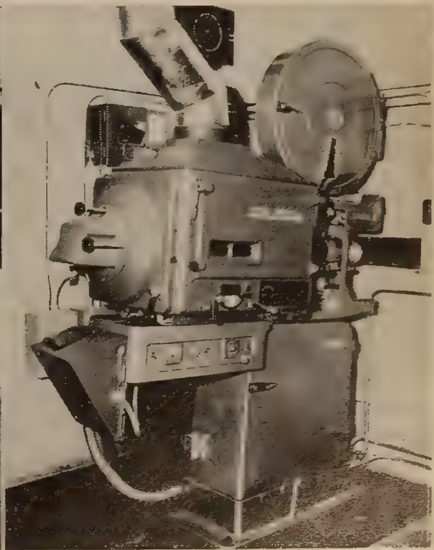

STATE THEATRE
Wichita Falls, Texas
35/70 on Victoria

BOOK REVIEWS

EYE, FILM, AND CAMERA IN COLOR PHOTOGRAPHY, by *Ralph M. Evans.* John Wiley & Sons, Inc., New York (1959). 410 pages, profusely illustrated (16-p. center section in color), and comprehensively indexed. *Cloth,* $8.95.

This is more than a book about the practical aspects of color photography: it is a uniquely thorough treatment of the psychology of vision as applied to photography in general. Ralph M. Evans, director of the Color Technology Division, Eastman Kodak Co., discusses his subjects with the familiarity born of experience and in the delightfully informal style which characterized his earlier book, *"An Introduction to Color."*

The first chapters of the present book analyze the nature of vision and the psychovisual aspects of the photograph *per se.* Although later chapters are mainly devoted to the optical and physical principles of both monochrome and color photography, Mr. Evans frequently relates his subject-matter to the fascinating facts of visual psychology.

Chapter 10, "Photography as a Creative Medium," correlates the esthetics of photography with practical applications of the medium. The illustrations are often presented in pairs for instant comparison of pictures both with and without special photographic characteristics. The color illustrations are beautifully printed and possess rare beauty and charm.

"Eye, Film and Camera in Color Photography" commends itself to everyone interested in modern photography, amateur or professional. Even the most experienced of photographers will benefit by a study of the new Evans book. —R.A.M.

MASTER RECEIVING—PICTURE TUBE SUBSTITUTION GUIDEBOOK *by H. A. Middleton.* John F. Rider Publisher, Inc., New York (1959). 352 pages, thousands of vacuum-tube diagrams and data listings. Paper covered, 8½" x 11", $7.45.

This is a completely reset revision of the original *"Receiving Tube Substitution Guidebook"* with all subsequent supplements. It is without doubt the indispensable "vade mecum" of electron tubes, including oscilloscope and TV cathode-ray tubes. Included are 5,100 American receiving-tube substitutions, 825 American picture-tube substitutions, and hundreds of American and European tube equivalents.

No radio, PA, or TV serviceman or technician can afford to be without this tremendously valuable *Guidebook.* It is a mine of information about tubes. Projectionists and theatre sound-service engineers, among others, will find the complete tube data valuable and virtually lifesaving when unforeseen emergencies require that a substitution of tube types be made. Special sections include helpful service hints.—R.A.M.

HOW TO GET THE MOST OUT OF TAPE RECORDING by *Lee Sheridan.* Robins Industries Corp., 36-27 Prince Street, Flushing 54, N.Y. (1958). 128 pages, amply illustrated with photographs and diagrams. *Paper,* $1.00.

A rare gem! Little in size but big in quality, Sheridan's *How to Get the Most out of Tape Recording* impresses this reviewer as tops in its field. A pleasure to read, this beautifully written book is a useful how-to-do-it manual which covers the entire field of sound recording on tape with great authority and thoroughness. Nothing of importance pertaining to the art is omitted: the reader is told the truth about tapes and accessories, how to buy and operate a recorder, how to place microphones and edit tapes, how to build a tape library, how to use a recorder for fun and profit, and even how to design and build a hi-fi stereo outfit.

Included in the book are descriptive and operating notes on all well-known tape recorders. Adequate space is devoted to stereophonic models; and a separate chapter discusses the care and maintenance of the equipment.

The constructive discussion of tape recording in education ("Time Saving Tips," p. 74 *et seq.)* is valuable to teachers and audiovisual supervisors, among others. There are even chapters on the legal aspects of tape recording, tape clubs (a wonderful idea!) and the making of phonograph records from tapes.

How to Get the Most out of Tape Recording is so comprehensive and practical that it has to be seen *and used* to be appreciated. Very highly recommended — and what a buy for only a dollar! R.A.M.

ALIGNMENT KIT

Continued from Page 15

within the screen masking.

A projector alignment with this tool gives optimum focus and best screen illumination, thus contributing to clarity and sharpness of picture presentation which is so often the subject of criticism.

The complete tool kit is distributed at cost price through the Motion Picture Council, Inc., 6660 Santa Monica Boulevard, Hollywood 38, Calif., for $32.50 postpaid.

Academy Awards Demonstration Held

HOLLYWOOD — Demonstrations of 19 technical achievements submitted for 32nd Annual Academy Awards consideration were held before members of the Scientific or Technical Awards Committee and subcommittees of the Academy of Motion Picture Arts and Sciences.

The following list is being publicized to permit those with claims of prior art or with devices similar to those under consideration to call them to the committee's attention:

Additive Color Printer, Bell & Howell; Cinemascope 55, 20th Century-Fox; 7-Position Portable Mixer, RCA; Exposure Meter, Ansco; Instantaneous Color Film Analyzer, Hazeltine Research Corp.

M-G-M Camera 65, M-G-M; Instantaneous Color Film Timer, Technicolor; Automatic Shutter for Motion Picture Printing Machines, Electronic Systems, Inc.; The Easy Editor, Joseph Yolo.

Kenyon Stabilizer, Gordon Enterprises; Wet Printing Equipment, Technicolor; Optical Printer for Special Effects and Travelling Matte Shots, Walt Disney Prods.; New Lamps for High-Speed Cameras, Westinghouse.

Bausch & Lomb Balcold Reflector, Bausch & Lomb; Norelco Universal DP 70 70/35mm Motion Picture Projector, North American Philips Co., Inc.; CF-2 Ultransonic Film Cleaner, Lipsner-Smith Corporation .

All-Electronic Film Footage Counter, Samuel Goldwyn Productions; Transistorized Film Footage Counter, Wells Engineering; Multiple Endless Cable Remote Controlled Winch, M-G-M.

* * *

Big Mirror

Largest piece of glass yet produced has been made by placing solid chunks of glass on a mold and sagging them into single mass at 2,300° F. The big piece is destined for use as an 84-inch telescope mirror being built for Kitt Peak National Observatory. Sagging reduces bubble inclusions in the 13-inch-thick mirror blank, made of borosilicate glass by Corning Glass Works. Grinding and polishing the mirror blank is expected to take 24 months.

OBITUARIES

J. S. Brunhouse, former Altec service engineer, died following a heart attack at his home late in December. He was initiated into Sacramento, Calif., Local 252, IATSE, March 1, 1938. Mr. Brunhouse developed and marketed speakers for drive-in theatres until his retirement a few years ago. He was one of the early pioneers in motion picture sound in the northern California area.

* * *

Eyeglasses — Focus

Among the hundreds of reports of free technical service being given to theatre owners by equipment dealers under the program of the Council for the Improvement of Theatres and Motion Picture Projection, is an occasional chuckle, Albert M. Pickus, president of Theatre Owners of America and chairman of the Council, has disclosed.

Mr. Pickus said the most recent incident was a report made to him by a major projection service organization on the problems of the owner of a small theatre in the Midwest, who complained his projection was not "sharp." The picture on the screen, said the owner, was fuzzy.

An equipment dealer made the first call. He returned with a field man from a projection company. Still the owner complained. They lent him a new pair of lens. Still, said the theatreman, the picture was not sharp.

In desperation ,the service supervisor of the projection company made a long trip to the theatre. His lengthy report to president Pickus, summarizing all that had gone before, concluded with this sentence:

"Mr. X...... (the theatre owner) finally admitted to me that when he put on his eyeglasses the picture was in focus."

There was no optometric charge for this service, Mr. Pickus said.

* * *

70/35 PROJECTORS

NEW YORK—Three 20th Century Fox houses in Africa have now been provided with Cinemeccanica 70/35mm multi-purpose projection equipment by the G. B.-Kalee Division of Rank Precision Industries Ltd.

PROJECTION DISTORTION

Continued from page 6

1:1.375 was chosen (aperture dimensions equal 0.600 X 0.825 inch.) This is a slightly higher aspect ratio than the old 3:4 ratio, *but it gives a 3:4-proportioned image on the screen when an average projection angle of 10 or 12 degrees prevails with lenses of the usual focal lengths.*

Corrective Measures

One interesting way to circumvent the effects of extremely steep projection angles (20 to 30 degrees) is to *displace* the lens and optical path of the projector while keeping the mechanism level, as shown in Figs. 2 and 3. This method, which eliminates *both* image elongation and keystoning, was actually utilized in Zeiss-Ikon Ernemann X projectors built on special order in 1952 to compensate for the 22-degree angle prevailing in the physics lecture room of the Eidgenossische Technische Hochschule, Zurich, Switzerland.

As clarified by Fig. 2, the secret of the success of the Ernemann X Steilprojektor is a lens capable of giving a sharp image over very wide angles. A normal projection

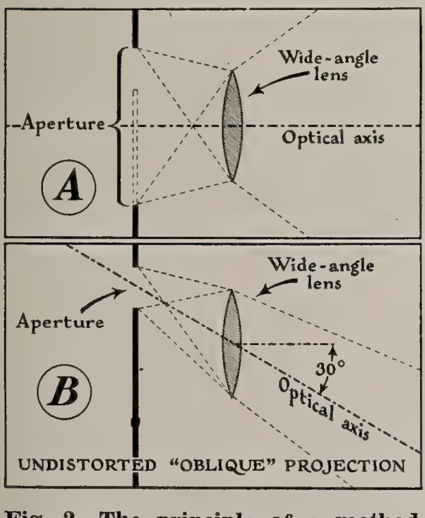

Fig. 2—The principle of a method used for undistorted projection at steep angles. In A is shown a conventional projection system having a very large picture-aperture and a special wide-field lens. If the extra-large aperture is masked off to leave only a 35-mm aperture at the top, as in B, the projection lens appears to be displaced relative to the new aperture. The optical imaging is the same as in A, however, and an undistorted picture results.

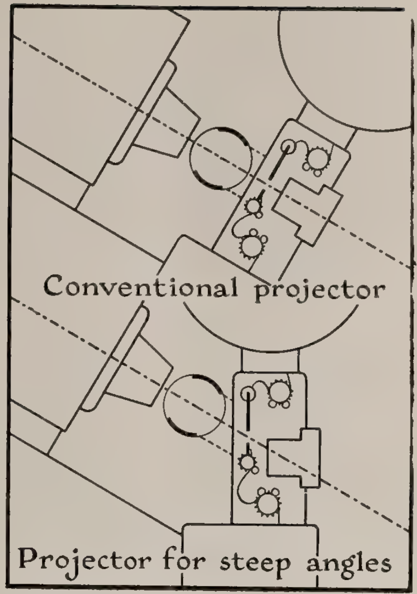

Fig. 3—Application of the principle illustrated in Fig. 2 to an actual film projector. Special projects for steep angles have been constructed by Ernemann (Zeiss-Ikon) of Germany.

lens, covering a field of view of about 15°, is unsuitable because, at a projection angle of 22°, a lens covering about 50° is necessary for sharp, bright pictures. This problem was solved by the Zeiss Alinar II wide-field projection lens.

In these days when anamorphic lenses are a commonplace, a simpler method of correcting projection-angle distortion suggests itself. "Mild" anamorphosis which *very slightly* compresses the height of the picture (or expands the width of the pitcure) would provide complete correction of image elongation and a small reduction of the keystone effect.

Curved-Screen Problem Unsolvable

Now let's turn to another projection-distortion condition which has been forced upon us by such modern widescreen processes as CinemaScope, and which actually defies complete correction. This is the geometric distortion produced by curvature of the screen.

Curved screens necessarily result in *some* distortion of the picture for *some* members of a movie audience even when the projection is head-on at a 0° angle. Even though projection under these conditions produces a geometrically perfect picture on a flat screen, a curved screen *is seen as curved* by patrons seated too far from the center-line of an auditorium.

Straight lines obviously cease to be straight when focused upon a curved screen: only curved lines can exist upon a curved surface. Vertical lines may indeed be straight, inasmuch as the screen is curved only horizontally; but all horizontal and oblique lines in the images will appear more or less bent when viewed from the side.

The unsuitability of the curved screen for regular motion-picture projection attains startling prominence when a moderate projection angle exists. In such a case the picture appears undistorted only to observers near the projection room, that is, only to patrons occupying the center seats in the balcony. To observers in even the choicest seats of the orchestra, all horizontal lines sag in the middle of the picture and all vertical lines near the sides of the screen lean in toward the top. This effect, called "horizon sag," is the most undesirable effect to be seen in professional projection today.

Prism-Type "Compensator"

A curious optical property of prisms suggests a remedy for horizon sag. Due to differences in the resultant refraction of light rays entering and leaving a prism at different angles a landscape viewed through a long prism appears to have acquired a horizon sag very similar to that so often seen on curved projection screens (Fig. 4). There is no "bowing-in" of vertical lines, however.

Ignoring the effect of dispersion, which produces a blur of colors on all horizontal lines, and which may be corrected by compounding the prism of flint- and crown-glass elements like an achromatic lens, such a prism may be used to counteract curved-screen horizon sag at any desired viewing level — but not at all viewing levels simultaneously.

In Fig. 5 we see the effects of horizon-sag compensation conveniently compared with non-compensated CinemaScope projection at two widely separated vantage points: a seat in the balcony very close to the projection room, and a seat "down front" in the orchestra. Note, however, that no horizon sag occurs at any point when a flat screen is used (top panel), no matter how wide the screen may be.

Without compensation, CinemaScope projected upon a curved screen shows a pronounced horizon sag and "bowing" of vertical lines

Fig. 5—The superiority of flat screens for CinemaScope projection lies in the absence of horizon sag and other straight-line distortions. When projected upon a curved screen without a prism compensator, steep projection angles result in a delineation which appears normal from the balcony of the theatre, but distorted by horizon sag to viewers in the orchestra seats. Conditions are reversed when a compensator is used, but the distortion seen from the balcony is a "horizon hump."

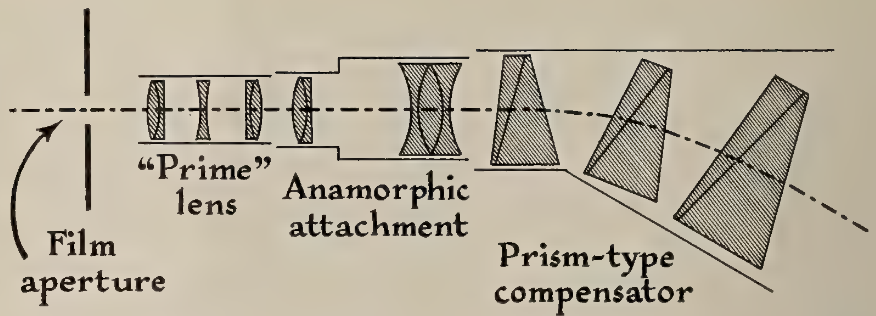

Fig. 6—A prism-type compensator for CinemaScope projection at steep angles is attached to the anamorphic lens. The prisms are of achromatic construction (two kinds of glass) to prevent the production of spurious spectrum colors.

as seen from the orchestra, but no such effects as seen from the vicinity of the booth. With the right amount of compensation, however, the picture can be straightened out for the choice orchestra seats, but the patrons in "seventh heaven" are treated to horizon lines which hump up in the middle of the screen. Take your choice: you can't get rid of the annoyance of screen curvature for the upstairs and downstairs at the same time!

Because the vertical lines in the view of the landscape seen through a prism in Fig. 4 do not lean in, but remain parallel to one another, a prism compensator cannot correct the keystone effect even though it straightens the horizon for *one* viewing level.

The actual construction of an optical compensator involves a train of several achromatic antireflection-coated prisms as shown in Fig. 6. Thus the complete objective system for compensated curved-screen CinemaScope projection consists of (1) a prime lens of suitable focal length, (2) an anamorphic lens-attachment of 2X expansion, and (3) the prism-type horizon-sag compensator. These three parts are carefully matched to one another to form a single compact unit having a total light transmission of 70 per cent.

Because of the downward bending of the light rays by the prisms, the projectors are set nearly level regardless of the projection angle when compensators are used. And although costing $15,000 a pair, such compensators have proved helpful in the few large downtown theatres where they have been used for both CinemaScope and Todd-AO, the anamorphic component being eliminated for the latter.

Flat Screens Best

The continuing trend back to flat screens makes such costly optical devices less necessary than formerly, however. In addition, the flat type of screen provides elimination of the curved-screen evils, something no special lens attachment can do, no matter how complex and skillfully designed.

The curved screen not only violates an important condition for satisfactory projection, but actually works against the optical characteristics of flat-field lenses. Providing no illusion of "surround" or "depth" whatever, the curved screen is one of the few items in present-day projection practice which may rightly be considered all bad. Its disappearance from progressive theatres should be hailed enthusiastically as a distinct step forward.

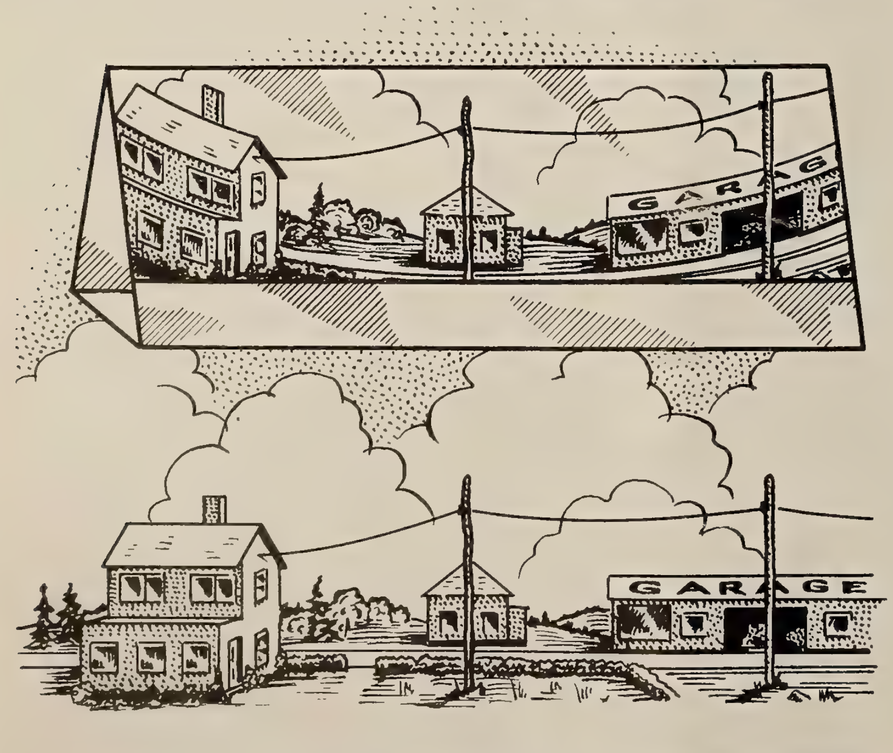

Fig. 4—A view of a level landscape seen through a long prism suggests a means of partially correcting the "horizon-sag" distortion of CinemaScope projected at steep angles upon curved screens. The "bending" of the landscape results from angular differences amoung the paths of the light rays.

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545 Fifth Avenue
New York 17, N.Y.
RAY GALLO
General Manager

MIDWEST OFFICE
Tenth Floor Upper Midwest Bldg.
Minneapolis 1, Minn.

FRANK W. COOLEY, JR.
Editor and Publisher

R. ENTRACHT
Associate Publisher

RAY GALLO
General Manager

R. A. MITCHELL
Technical Editor

In this issue . . .

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MONTHLY CHAT

More Lifelike Motion Possible?

BOTH LIVE TV and Todd-AO 70-mm projection prints have refocused industry attention upon the long-established frame rate of 24 exposures per second for sound motion pictures. The continued feasibility of this "standard" frame rate is now being questioned, and rightly so.

Projected movies made their debut in France and Germany almost 65 years ago at the frame rate of 16 per second, the old "silent" standard. Considering the low luminance of the early nickelodeon screens and the novelty of pictures that actually moved, 16 frames each second was an eminently satisfactory speed. The wonder of photographically reproduced movement mesmerized audiences into ignoring the minor nuisance of flicker.

But motion pictures are no longer regarded as "galloping tintypes," a mere visual sideshow. Today's critical moviegoing public insists on absolute perfection in motion, color, and sound. The new widescreen movies must be bright, sharp, and lifelike, above all else, and they must not be the least bit "flickery."

Now, it is a fact that the standard sound-speed rate of 24 frames per second is just a trifle too low for smooth, lifelike motion. Even when 3-blade shutters are used to eliminate "shutter flicker," a rapidly moving object evidences a "motion flicker" which reminds the moviegoer that he is watching, not a magical wonder-world of lifelike perfection, but a series of snapshot "stills" projected in rapid (but not *sufficiently* rapid) succession. Inescapable comparison with both 70-mm Todd-AO and live and taped TV emphasizes this defect of ordinary movies.

30 Versus 24 Frames Per Second

Todd-AO pictures *on 70-mm film* are photographed and projected at 30 frames per second. Not only is shutter flicker eliminated even from the most brightly lighted screens (the difference between 60 and 48 cutoffs per second), but even the most rapidly moving objects in the pictures appear to move *smoothly*. The discontinuous "flickery" effect so often seen in conventional movies is absent.

Live and taped TV presents a similar demonstration of the desirability of a high frame rate; but, considered *as a motion picture*, even TV is inferior to 30-frame Todd-AO. The 30 interlaced fields of American television are exactly analogous to a movie frame fate of 30 per second and to a shutter cutoff frequency of 60 per second; but TV, unlike a *filmed* motion picture, suffers from the "discontinuity" of successive line scanning.

The motion flicker apparent in 24-frames/second films is a source of annoyance to TV movie photographers who vainly wish that their films might present a more "live" appearance on the home picture tubes. A partial solution is to "shoot" with the camera shutter wide open to blur the edges of moving

(Continued on Page 22)

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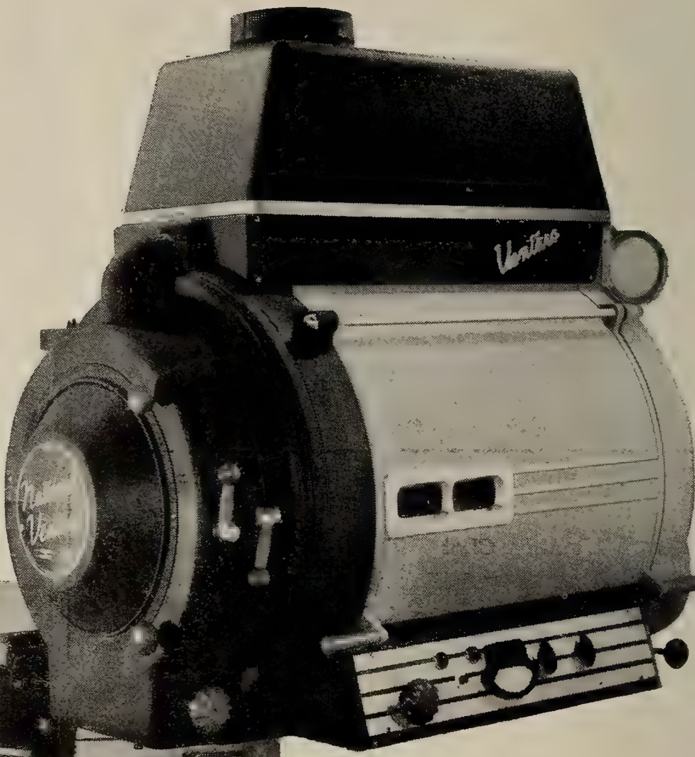

The Ventarc has been proved against all other lamps to be positively the most powerful by far. No other lamp comes even close. It employs a totally new and different technique—a three-dimensional, cylindrically-shaped light source—and a 21-inch reflector, the largest ever used. The Ventarc projects double the light of any lamps using 16½″ reflectors, 51% more than lamps using f 1.7-1.8 lens. AND—the Ventarc is designed for use with 70 mm projectors as well as 35 mm.

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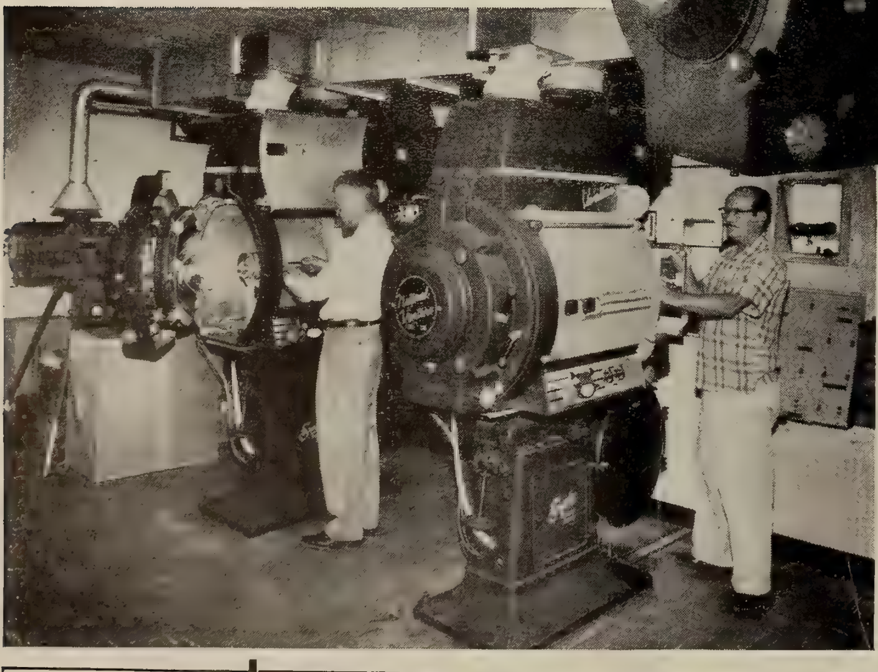

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INTERNATIONAL PROJECTIONIST

Volumne 35 March 1960 Number 3

Large-Area Frames and Picture Quality

By Robert A. Mitchell

A Two-Part Discussion of the Development of the Wide-Screen Processes and Projection Problems

THE FIRST commercial use of a larger-than-normal screen made an uncertain debut in the days of silent movies. A vastly oversize screen, movable screen masking, and a short-focus "Magnascope" lens enabled sequences from such memorable pictures as "Old Ironsides" (1926), "Wings" (1927), "Chang" (1927), and "Moby Dick" (1930) to be enlarged in a spectacular manner. The Magnascope was devised by a projectionist, Harry Rubin of the New York Paramount Theatre.

By vastly increasing the size of standard 35-mm film images, the Magnascope lens had the bad effect of increasing the apparent "graininess' of the picture and reducing the already deficient screen illumintaion produced by old-style arc lamps. The resulting coarse-structured, grayed-out images made it painfully obvious that the Magnascope was only a novelty device to be used very sparingly. The gigantic screen had to wait for future improvements in film images and projection lamps.

Wide Screen not New

The concept of *panoramic* motion pictures nevertheless appealed to many inventors at an early date. The anamorphic lens, invented by Ernst Abbe of the Carl Zeiss Works in 1897, and later much perfected by Henri Chretien of Paris, has been available to moviemakers from the earliest days of filmic art. But when the latent interest in widescreen projection was rekindled by the introduction of sound in the late 1920's, the pressing problems presented by emulsion grain and screen illumination automatically turned the attention of producers to film stocks wider than the standard 35-millimeter width.

Indeed, every major studio had its pet widefilm process in the late 'twenties and early 'thirties. Paramount had its 65-mm Magnafilm, with projectors to show it manufactured by Ernemann of Germany. M-G-M's Realife process never quite got off the ground, but the old Fox Company's 70-mm Grandeur process, employing modified Debrie cameras and Super Simplex projectors, was exhibited to indifferent audiences at the Gaiety Theatre in New York and the Carthay Circle Theatre in Los Angeles. The premiere film was "Happy Days," which was shown at an aspect ration of 1:2. The monoaural sound was reproduced from an optical Movietone (variable-density) track 7-mm wide to reduce the noise level.

A textbook on motion-picture sound recording published in 1931 stated that "no general agreement has yet been reached among the motion-picture companies for specifications of wide film. The advantages and disadvantages of a picture image which extends 50 feet across the screen are still being debated." Actually, producer and exhibitor resistance, combined with public indifference to the few widescreen showings which had already been presented, left nothing to be debated.

The moviegoing public was still very much overwhelmed by the novelty of sound — pictures advertised as "100 per cent all-talking," and which were, in fact, 100 per cent garrulous. Why expand the screen for actors who merely stood motionless around a hidden microphone and chattered incessantly? Mastery of sound as a medium of dramatic expression was yet to come.

The theatre owners, on the other hand, had been overwhelmed by sound in a different way. The soundtrack was employed by the pirates of high finance to

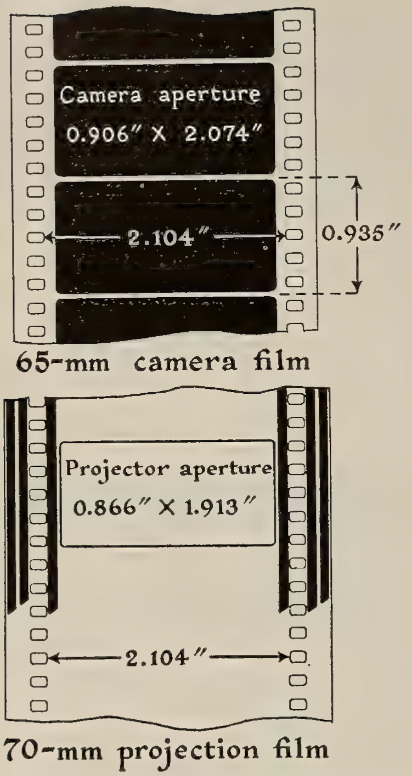


FIG.1— The perforation pitch of standardized 65-mm and 70-mm films is the same as in regular 35-mm film (0.187 inch from the pulldown edge of one sprocket hole to the pulldown edge of the adoining one). The 65-mm width is used in the picture camera, and is contact-printed on 70-mm film to accommadate the extra magnetic soundtracks for full stereophonic sound. The effective width of each of the 6 magnetic tracks is 0.06 inch.

hamstring every independent exhibitor on the North American continent. With no discernible end to payments of tribute to the sound-equipment combine, additional outlay for new widefilm equipment was unthinkable.

The producers, most of whom rankled in the straitjacket with which sound had stifled the fluidity of filmic art, vetoed the wide screen almost unanimously. Most eloquent of all was Sergei Eisenstein, the famed producer of "Potemkin" and many other amazing silent films. His verbal blast at widescreen aspect ratios accomplished at least as much as the deepening economic depression to induce the Motion Picture Producers' Association in 1931 to assure exhibitors that no further attempts to change the standard screen would be made.

Modern Preference for Panorama

The exhibitors who were still paying heavily for having their theatres "wired for sound" were thereby saved. No serious attempt to introduce wider screens was made until the early 1950's, in fact. But conditions were vastly different in those later years. The novelty of television and the increasing staleness of Hollywood film-fare frightened the industry into adopting a broader outlook — an outlook that we now know has been largely responsible for the current increasing prosperity and popularity of theatrical motion pictures.

After a brief period of trying and rejecting the 3-D process, the industry wisely turned to larger, wider screens and spectacular "blockbusters" to foster interest in cinema attendance. Fortunately, natural-color cinematography had attained a high degree of perfection, magnetic stereophonic sound was available to theatres requiring it, and the artistic techniques of the soundfilm had long since been thoroughly mastered. And Chretien's anamorphic lens was available. The only remaining problem concerned the production of 35-mm release prints sharp enough to withstand the tremendous magnifications demanded by the new realistic screens of panoramic aspect ratios.

As every projectionist knows, great forward strides in movie photography and film printing have been made. Even the Technicolor dye-imbibition printing process, noted for economy and consistently good color quality, although not for high image resolution, was improved to give images of sufficient clarity for widescreen projection. But the struggle for perfect image clarity has not been completely successful, and the battle against blur continues apace in every department of motion-picture technology.

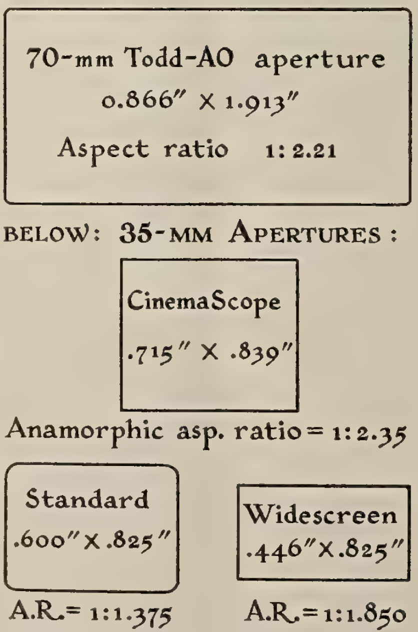


FIG.2—A comparison of the relative sizes of the Todd-AO 70-mm projector aperture and the three most commonly used 35-mm apertures. The widefilm aperture has 3.347 times the area and light-transmitting capability of the standard Academy 35-mm aperture.

Serious Technical Problems

Given fine-grain negative film for use in the camera, the standard 35-mm film frame is generally considered to be large enough for satisfactory projection on screens up to 30 feet wide, particularly if the CinemaScope anamorphic process is employed for aspect ratios greater than 1:1.85, the usual "non-anamorphic" widescreen aspect ratio. When the screen is wider than 30 feet, as in large city theatres and nearly all drive-ins, three unfavorable effects begin to mar the quality of the projected pictures, namely:

1. Excessive magnification of the image reveals the grainy structure of the negative emulsion (and the inherent misregistration and dye-diffusion blurriness of color prints).

2. The small size of the projector aperture does not permit the passage of sufficient light to illuminate extremely large screens to a light-level high enough for comfortable viewing.

3. The maximum light flux possible with the most powerful arc lamps induces forcus-ruining film buckle and risks damaging the prints *even in cases where the screen light is insufficient because of enormous screen area.*

Graininess of the image has already been greatly minimized by the use of large-frame negatives and special cameras. (Vista-Vision and Technirama on horizontally-running 35-mm film, CinemaScope-55 on 55-mm film, and Todd-AO, M-G-M "Camera-65", and Panavision on 65-mm film.) The widespread use of full color has also brought about important refinements in all color-printing processes, contributing significantly to the resolution of the projected images.

Improved Color Prints

Definitionwise, the best color prints are those made directly on multilayer print stock (Agfacolor, Eastman Color, Gevacolor, Ferraniacolor, Sovcolor, etc.) with the

usual black-and-white separation-positive steps being avoided either by contact-printing from the original camera negative (admittedly an impractical procedure in professional work) or by the use of multilayer intermediate films. But unless some degree of distortion or desaturation of the original colors can be tolerated, however, better *color* results are obtained by the use of Technicolor imbibition printing and all its attendant color-balancing, separation, and matrix-printing steps, some of which involve optical printers.

The refinements which have been made in Technicolor prints since the inception of the wide screen in 1953 are most impressive. Not only is a wide assortment of suitable acid dyes available to the imbibition process, permitting selection of a set which gives remarkably accurate color reproduction, but the blank gelatin-coated print stock is now treated with improved mordant chemicals to accelerate the imbibition of dye from the relief-image printing matrices and to minimze dye-bleeding to the point where a modern Technicolor print may compare very favorably in sharpness with a print on multilayer stock. Nevertheless, there is still some difficulty with the matrix films, which can give no more than 50 prints before the images become blurred and otherwise defective.

Negative-Grain Problem

Negative graininess has always been a troublesome factor in motion-picture technology because the more light-sensitive the negative stock, the coarser the agglutinations of silver clumps in its emulsion, as a rule. Thanks to the unceasing search for fine-grain developing agents and for new methods of reducing grain size in "fast" negative emulsions during manufacture, modern panchromatic emulsions are actually less grainy than the much slower negative emulsions of former years.

The grain structure of "slow" positive print-film stock is so extremely fine that it has never presented any problems no matter how great the magnification of the image in projection. Negative grain, on the other hand, limits the resolution of the image much more severely than do the slight optical imperfections of the fine camera lenses used in professional production. Accordingly, the optimum-resolution norm of 50 lines per millimeter on the negative is seldom attained.

Color negative, the emulsion of which consists of three thin black-and-white emulsions in adjacent layers, is by no means exempt from the grain problem; but in color images excessive graininess usually results in a soft blur. The grain structure of the green-recording layer which forms the magenta dye image in the print has the most effect upon the overall clarity of the image.

Optical vs. Contact Printing

When B & W separation positives are made from color negatives, as is usually the case in professional work to facilitate scene-to-scene color balancing, to preserve the color values in terms of permanent silver images, and to take advantage of lower insurance rates, there is always the possibility of misregistration when the three separate color records are re-combined in the duplicate negative from which the release prints are made. Optical printing, necessary for the production of standard 35-mm prints from large-area negatives, increases the likelihood of accidental misregistrations and focus defects. Needless to say, only the finest, most carefully focused lenses should be employed in optical printing.

It is generally believed that contact printing preserves the definition of high-quality original films better than does optical, or projection, printing. When the area of the negative frame is greater than that of the positive frame, however, careful reduction printing increases resolution by reducing the negative grain along with the picture image.

It is also generally conceded that, in order to obtain better image quality from large-frame negatives, the area of the negative frame should be at least 2 times greater than that of the positive frame. Reduction of a full-frame 35-mm negative ("silent" aperture) to standard sound-aperture dimensions in the print loses almost as much in optical reduction printing as it gains in the resulting small diminution of negative-grain size. The full silent frame has only 1.27 times the area of the standard Academy soundfilm frame.

Small Frame for Field Depth

There is likewise an *upper limit* to the size of a practical large-area

negative frame. The larger the camera aperture, the longer must be the focal length of the lens used to include a specific angle of view, and the longer the camera-lens focus, the more restricted is its depth of field *when the same lens f-number is considered.* In other words, a long-focus lens can include *in sharp focus* only a limited range of subject-distances.

The focal lengths of the lenses used on motion-picture cameras are computed on the basis of two factors: the angle of view it is wished to include and the height (*not* the width)of the aperture. If a lens of *n* inches E.F. is suitable for a given shot in conventional 35-mm filming, horizontal VistaVision and Technirama will require a lens of 1.2*n* in. E.F., and 35-mm CinemaScope will require practically the same lens under the same circumstances (1.19*n* in. E.F).

These requirements are nevertheless not excessively demanding. Camera lenses are usually "stopped down" somewhat to prevent overexposure and to increase the depth of field. All of the currently employed 65-mm processes (including Todd-AO) require a relative lens E.F of 1.44*n*", which may be considered to be very close to the limit of feasibility.

In general, therefore, the depth of field is slightly less satisfactory in the large-frame processes, but tests indicate that, *for all practical purposes,* field depth may usually be regarded as approximately the same in all the commonly used processes, conventional and large-frame, *when the same type of negative stock is used in the cameras.*

(To Be Concluded)

* * *

Toronto Election

TORONTO — James Sturgess was elected president of the Toronto Motion Picture Projectionist IATSE Local 173, with Bert Measures vice president, Andy Pura secretary-treasurer, Roy O'-Connor recording secretary and A. L. (Pat) Travers as business agent.

The executive board includes Russ Sturgess, George Rands, Wilf Jackson and Jack Tinkler. Richard Topping is tyler, Bill Laidlaw sergeant-at-arms, and George Jones, Pat Travers and Jim Sturgess are convention delegates.

BUSINESS NOTES

Curry E. Ford has been named director of marketing for National Carbon Co. Division of Union Carbide Corp., it is announced by C. J. Chapman, vice president-marketing responsibilities for the company's complete line of industrial carbon and graphite products. Mr. Chapman also announced these additional new assignments in National Carbon's marketing organization: Reporting to Mr. Ford will be James King, Jr. as manager of electrode products; A. W. Wolff as manager of industrial carbon products; W. C. McCosh as manager of carbon products; and W. G. Pitt as manager of new product market development.

Marvin A. Snow has been appointed manager of professional sales for Ansco, the photographic manufacturing division of General Aniline Film Corp. according to Robert M. Dunn, Ansco's director of marketing. Mr. Snow, a graduate of Whitman College, is a native of Bismarck, N. D. He has been with Ansco 22 years. He will now direct the planning and promotion of the company's films, cameras, papers, and chemicals to industrial, professional and commercial photographers in the U. S. and Canada.

Further expansion of the government services activities of the RCA Service Co. has been effected with the opening of two new regional offices and the appointment of four new marketing managers. The new regional offices are in Rome, N. Y., and Los Angeles, Cal. Existing offices are located at Dayton, Ohio, covering the South-Central region, and at Washington, D. C., for the Southeast region.

Herbert A. MacDonough has been appointed to the newly created position of manager of product marketing for Ansco, the photographic manufacturing division of General Aniline & Film Corp.

* * *

New Projection Screen Patented in England

A projection screen characterized by superior light reflection over wide viewing angles has recently been patented by Harkness & Harkness of London, according to the *British Journal of Photography*. The reflective surface of the new screen is the result of special lacquers applied to a white screen-base material, preferably of plastic.

The undercoat is essentially a brilliant white paint composed of titanium dioxide suspended in vinyl chloride-vinyl acetate copolymer. Over this is applied several overlapping coatings of a colorless varnish to which has been added a plate-like crystalline ingredient having a high refractive index and, consequently, a high reflecting power.

In one specification this material consists of crystals of bismuth oxychloride. In the other screen disclosed, a lustrous basic lead carbonate in crystalline form is used.

The final surface coating presents an array of crystals in overlapping, chaotic disposition, which is believed to account at least in part for the same high reflectance over a wide viewing angle.

This has been going on since 1917!

Yes sir, National Carbon Company has provided free screen lighting technical assistance to the industry since 1917. Today, 12 sales engineers—equipped with compact service kits containing the most modern tools in the trade—are ready to assist on any screen lighting problem you might encounter.

Use "National" projector carbons and call on NATIONAL CARBON for free technical service. It's a tough combination to beat—the best in product . . . the best in service. You'll realize the ultimate in picture quality at the lowest overall cost.

Each salesman's kit contains the following modern equipment: brightness meter, voltohmmeter, clamp-on ammeter, dummy lens, set of alignment rods and accessories, pin-hole apertures, split-plate aperture plates, stop watch, micrometer, ruler and slide rule.

AUDITORIUM OF RUSSIA'S Kinopanorama Theatre where motion pictures are shown on a series on individual screens arranged in two circular tiers. There are no seats and spectators stand or walk about as they view the exhibition with its stereophonic sound. At the time the photo was made, only the lower tier of projection screens was being used and the upper tier was dark. (Photo courtesy USSR).

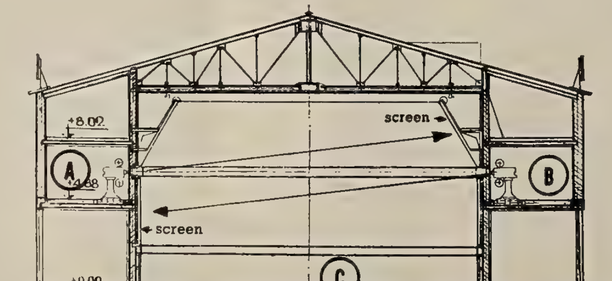
Russia's Kinopanorama System Uses Eleven Cameras, Two Tiers Of Screens in Circle

A UNIQUE method for exhibiting motion pictures was unveiled by the Russians at the new Kinopanorama Pavilion, which was opened to the public in Moscow on July 22, 1959.

This circular cinema theatre (*Krugovaya Kinopanorama*), erected near the southern entrance to the USSR Exhibition of Economic Achievements, in Moscow, is fascinating to Russian movie fans because of the unusual projection techniques and the exciting effects produced. The audience can see moving pictures on two bands of 360° screens—one under the other—below the dome of the auditorium.

The circular Kinopanorama is a further development of the Russian panorama system, shown for the first time in Moscow in 1956 and at the Brussels International Exposition in 1958. The Russian panorama system was adapted from ideas originally suggested by the French in 1926 (also said to be the basis for the American Cinerama system). The new Kinopanorama system is similar to the American Circarama developed by the Walt Disney studio in 1955. Both systems are based on synchronized projection of a picture by eleven projectors on a 360° screen divided into eleven segments. However, the Russian system differs from its American prototype in that it has two circular bands of screens, one above the other, while the American Circarama has only one. Another advantage that the Russians claim is the perfected quality of the system's stereophonic sound. While in the American Circarama one hears only the music and the announcer's voice, in the Russian system the sound effects are synchronized with the action to point up all that is shown on the screen.

The method of filming the Kinopanorama pictures is basically the same as that of the Circarama. Shooting of a scene is done with eleven synchronized cameras mounted on a single base plate and arranged to cover a 360° view. The equipment differs somewhat from that of the American and European studios. The Russians claim that the special technical and artistic characteristics of the Kinopanorama derive from the fact that they use a new type of mirror camera for scenic shots invented by Kirill Dombrovsky. For sound recording they use the nine



CROSS-SECTION of Russia's circular Kinopanorama theatre. It consists of three floors: the first (C) is the auditorium where spectators view the screened pictures. The second and third floors are actually balconies surrounding the open auditorium and its screens. Position of projectors for throwing pictures on the lower and upper screens is shown at A and B — each machine projecting its segment of the film to a screen directly across the auditorium. (Courtesy Arkhitektura i stroitel'stvo Moskvy.)

EDITOR'S NOTE — The accompanying article, thought extremely interesting to projectionists throughout the world because of its illustration of current Russian projection and cinematographic developments, is reprinted by permission through the courtesy of American Cinematographer. Authored by Arthur Voyce, it appeared in the January, 1960, issue of that publication.

channel system invented by K. Bek-Nazarov.

The circular auditorium accommodates 300 people. The audience, surrounded by two segmented circular screens, watch scenes projected by 22 separate projectors in sync. The projection of the film, with respect to the segments of the two screens, is in the nature of a series of related scenes of one general theme.

The projectors are located behind the screens, and are arranged along the perimeter of the auditorium wall, each machine throwing its image through a slit in the wall to the screen-segment opposite. In order to eliminate vibration, the projectors are set on individual foundations entirely independent from the structural elements of the floor. A single control panel simultaneously sets in motion both groups of the projecting apparatus.

There are no seats in the auditorium and the spectator walks about as he pleases and watches any part of the film he likes. If he looks at the part where the camera dollied forward, he feels as though he were also moving along with the camera. But if he looks at the sides, he sees everything the cameramen witnessed as they shot the scenes round them.

The lower screen is 12' high. In order to obtain good visibility, it is placed at a height of 8'-2° from the floor. Above this screen is the second circular screen, shaped like a truncated cone, 13'-4° high. The upper screen is erected at an angle of 59° to the auditorium floor; its top is on a line with the ceiling.

The system of screens, ringing the circular walls, is vertically divided by velvet strips 6'' wide. Horizontally the upper and lower screens are separated by a velvet strip 20'' wide, which has unobtrusive projection ports for 22 huge projection machines. Eleven of these machines project the

(Continued on Page 20)

AUDIO-VISUAL
EDUCATIONAL • INDUSTRIAL • COMMERCIAL

Tape Recorder is Among Most Valuable A-V Instructional Tools

THE MAGNETIC-TAPE RECORDER is to be reckoned among the more valuable instructional aids available to the modern teacher. Even though disk records are to be preferred for certain teaching purposes, the versatility of magnetic tape as a recording medium undeniably places it in a uniquely important position.

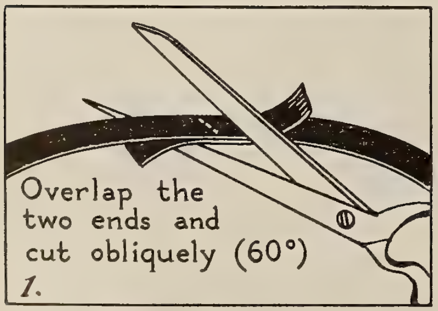
Sound tapes are more easily damaged through careless handling than are plastic disk records, and they are more troublesome to play because they must be threaded through the tape instrument and afterward rewound if only one side has been played.

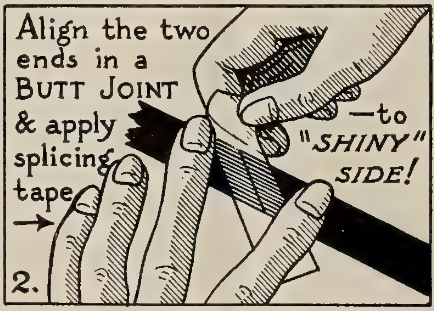
If not torn or subjected to unfavorable climatic and magnetic influences, a sound tape is practically permanent. It can be used thousands of times with no perceptible deterioration of sound quality. The surface-noise level of magnetic recordings is lower than that of disks, and the frequency range is more extended. And unlike most other sound-recording media, magnetic tape can be played back immediately after being recorded, and even erased, if desired, to prepare it for a fresh recording. Furthermore, the same tape that has been used for monoaural recording can be used for stereophonic recording.

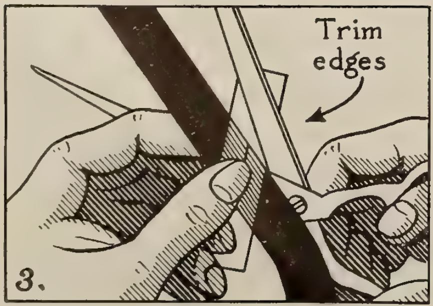
Standard Tape Speeds

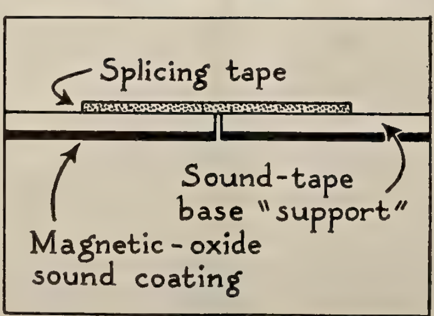
Magnetic tape consists of a thin ribbon of plastic (cellulose acetate or a polyester material such as Mylar) which has been coated on one side with a preparation of chocolate-brown iron oxide capable of retaining the magnetic variations of the sound current. When the tape is played, the magnetic variations passing under the 0.0001-inch "gap" of the recording head induce a replica of the original sound current, which is amplified and fed into a loudspeaker.

The frequency-range of the magnetic recording process depends upon the fineness of the recording-head gap — the minute distance separating the poles of the sound electromagnet — and the linear speed of the moving tape. The standard "professional" tape speed was originally set at 15 inches per second; but inasmuch as a sufficiently extensive frequency range (from 30—40 to 12,000—15,000 cycles per second) can now be obtained at half this speed, tape recorders intended for high-fidelity recording usually operate at a maximum tape speed of 7½ ips. Most of the commercially available recorders also operate at 3¾ ips to double the playing time; and the resulting restricted frequency range (50—70 to 7,000—10,000 cps) is suitable for speech and all less exacting purposes. Recorders intended only for stenographic dictation often employ the economical tape speed of 1⅞ ips (80—100 to 4000—5000 cps).









Tape Dimensions and Types

"Standard-play" tape is ¼" wide and 2 mils (0.002") thick; the plastic base having a thickness of 1½ mils, and the magnetic coating about ½ mil. A 7-inch diameter reel of SP tape holds 1,200 feet with a playing time of 32 minutes if the tape is operated in one direction only at 7½ ips, or a total of 64 minutes for two "half tracks," the second track being recorded by reversing the reel and playing the other side of the tape.

"Long-play" tape has a base thickness of about 1 mil, hence a 7-inch reel accommodates 1,800 feet with a playing time of 48 minutes for a single track, or 1 hour 36 minutes for two half tracks, at 7½ ips. "Double-play" tape has a base thickness of ½ mil and a total thickness one-half that of SP tape. This extremely thin tape doubles reel capacity and playing time.

The disadvantages of LP and DP tapes are greater susceptibility to stretching and tearing, and increased "print-through," or magnetic echo produced by the transfer of magnetic fields from one layer of tape in a roll to adjoining layers. Special "low print-through" tapes have thin oxide coatings on standard 1½-mil base. Conversely, the so-called "high-output" tape has a magnetic coating which is thicker than the standard coating.

Condition of Head Critical

Because nearly all commercial tape stocks are capable of accepting

LENS ATTACHMENNT . . . An accessory CinemaScope (wide screen) lens attachment has been announced by Victor Animatoraph Corporation Division of the Kalart Company, Inc., Plainville, Conn. Called the "Victorscope", the new anamorphic lens will convert any 16mm projector for showin CinemaScope wide screen movies. Brackets for mounting the lens to all Victor projectors are available from Victor and brackets for other projectors will be available on special order. The new lens may also be used as a supplementary camera lens for photoraphing movies in CinemaScope; special adaptors to fit most cameras are available. The "Victorscope" anamorphic lens lists at $169. The name and address of local Victor dealers can be obtained from the company.

a high-quality audio signal with few sound "dropouts," the quality of the recorded sound is largely dependent upon the condition of the combination recording - playback head, assuming that the microphone, loudspeakers, and amplifiers perform satisfactorily, and that the tape moves with great uniformity. (An irregular tape motion causes "flutter" and "wows" in the sound.)

A tape-recorder head is analogous to the cutting and playback styli of disk-record machines, and are likewise subject to physical wear. A worn tape-recorder head produces severe distortion of the sound, imparting to it a harsh or unnaturally "metallic" quality. To obtain the excellent sound reproduction of which the magnetic-tape process is inherently capable, therefore, the magnetic head must be properly cared for, kept scrupulously clean, and replaced whenever damaged or worn.

A severe scratch accidentally inflicted upon the pole pieces and tissue-thin gap of a magnetic head by a screwdriver or other sharp instrument may render the device unfit for further use. Accumulations of iron-oxide dust, grease, tape lubricant, and splicing-tape adhesive may also have a ruinous effect upon the sound, causing distortion and low output; but unlike actual physical damage, dirt can be removed to restore the performance of the head. We suggest the use of a fine camel's-hair brush for the removal of light surface dust and, for more stubborn deposits, a lint-free cotton cloth lightly dampened with Carbona, Freon, or Robins HT-2 cleaning fluid made especially for the purpose.

Direct application of cleaning fluid to a magnetic head, while sometimes necessary, should be done cautiously. Pipe cleaners are very useful for this delicate job, for they minimize the possibility of getting the fluid on rubber pressure rollers.

Maintenance Tips

The tiny felt pressure pads which hold the tape in contact with the magnetic head should be parallel to the gap both vertically and horizontally. If they are seen to be misaligned, twist or bend the spring mounting by means of small, thin-nose pliers until the pad applies uniform pressure over the whole contact area. Also adjust the screw for sufficient pressure to insure firm contact of the tape against the head, but avoid excessive tension. Worn pads should be stripped away and replaced with new pads cemented in position.

Periodic demagnetization of the head mechanism often serves to eliminate troublesome distortion and reduce hum and other background noises. Head demagnetizers must nevertheless be used according to the manufacturer's directions to avoid the risk of increasing, rather than removing, magnetism. As a general rule, pass the demagnetizer over and around the head and move it away gradually some distance from the head before turning it off. Keep all tapes far, far away from the demagnetizer!

Most modern tape recorders incorporate permanently sealed bearings which never need additional lubrication. Even older models should be oiled very sparingly. All excess lubricant should be wiped off immediately, for oily machine parts collect dust, become grimy, and invite wear and operational trouble.

Cleaning and Storage of Tapes

Tapes which have been used many times should be cleaned by passing the tape through a lintless cotton pad lightly moistened with Freon film cleaner, Carbona (toxic!), or a commercial tape- or film-cleaning fluid. *Do not use magnetic cleaning fluids for cleaning tapes!* Many tape recordists recommend such silicone-impregnated cleaning cloths as the FilMagic and the Jockey. Whichever is used, refold the cloth frequently to avoid scratching or soiling the tapes with previously removed dirt.

The long-term storage of magnetic tapes requires more than passing thought because high temperatures and excessively high or low relative humidities have an adverse effect upon them. Polyester (Mylar) tapes are less affected by unfavorable storage conditions than are celloulose acetate tapes. All the major American brands of tape can be obtained in either type of base (Scotch, Audiotape, Irish, Soundcraft, etc.). The ideal conditions for tape storage are temperatures between 65 degrees and 75 degrees F and relative humidities betwen 35 per cent and 45 per cent.

Tapes should be wound uniformly under light tension on plastic or aluminum reels for storage. Reels of tape should be kept in dust-tight boxes or cans, for dust

(Continued on Page 19)

Electric Slide Changer Handy For A-V Presentations

When large meetings are held in hotel ballrooms or auditoriums, audio-visual equipment is used more and more to illustrate lectures. Slides are much less expensive to make than a film and when a powerful slide projector and a large screen are used, good slides can efficiently hold the attention of the audience.

The present trend in the projection of slides in large meetings is to have a great number of slides which are changed at a fast speed. Frequently, for instance, 50 or 60 slides are used to accompany a twenty-minute lecture and sometimes as many as 10 slides are changed within a minute. For the operator of the slide projector it means a great dexterity, if he has to change the slides manually.

Electric Slide Changer For Fast Changes

Since standard 3¼x4 slides are generally used for presentations or meetings with an audience of 100 persons or over, an electric slide changer for 3¼x4 slides makes the work of the operators much easier. The Genarco Electric Slide Changer Model 6800 is comprised of a loading magazine in which as many as 70 slides are placed before the show; a receiving magazine which will receive the slides after they have been projected; and a motor-driven mechanism which picks up one slide from the loading magazine and moves it to the aperture while it removes the preceeding slide from the aperture and moves it to the receiving magazine.

When the operator has placed the slides to be projected in the loading magazine in the proper sequence and with the proper end up, he is sure that they will be projected in the proper sequence and he does not have to fear that one image will appear on the screen upside down or reversed.

All the operator has to do after the slides have been placed in the loading magazine is to press the push button when he gets the cue. Between the moment that he presses the button and the moment that the new slide is in the aperture less than ½ second has elapsed and the operator is ready to press the button for the next slide even when the pace is very fast.

The operator has the push button in one hand and his other hand is free. He can use it to make a final or more perfect focussing of the image on the screen or make a last instant correction of the leveling of the image.

Since he is not busy moving from one side of the slide projector to the other, placing and removing slides from one end or the other end of the manual slide changer, he can quietly sit on the side of the slide projector observing the image which is being projected. If necessary he can also follow the script and press the button when the cues appear in the script.

Smooth Show

The makers of slides for professional projection are now aware that they must also supply the projection with blackout slides which are inserted among the slides to cut the light beam in the slide projector when no image is to be projected on the screen.

A blackout slide is made like an ordinary slide except that instead of having a film positive between the two cover glasses a piece of opaque white paper 3¼''x4'' has been inserted. When a meeting starts, the lecturer generally talks before the first image is projected. During his talk it may happen, once or several times, that the light is turned on in the auditorium or ballroom and that no image should be projected on the screen.

Generally at the end of the talk the lecturer speaks with all the lights on and no image projected. It is very convenient, therefore, to have a blackout slide placed in front of all the slides in the loading magazine and to have one blackout slide corresponding to each period of time when no slide is being projected — and, finally, to have one blackout slide placed after the last slide to be projected.

Before the lecture starts the projectionist brings the first blackout slide in the aperture of the slide projector. When the lecture starts, he turns the current on the slide projector. No image is visible on the screen since a blackout slide is in the aperture.

When the first image has to appear, the projectionist presses the push button. Later on during the lecture if no image is to appear on the screen, the projectionist presses the push button which brings the corresponding blackout slide and he does not have to turn off the light during that period of no projection. At the end of the projection period, when the last slide is being projected, and at the moment that the light will be turned on in the auditorium, the operator presses the push button to bring the last blackout slide in the aperture. This method is very simple and very smooth.

Adaptable on All Projectors

The electric slide changer for 3¼x4 slides can be mounted on all semi-professional or professional slide projectors. It can be mounted on the 750 watts and 1,000 watts slide projectors made by Beseler, American Optical and Heiland Golde. It can be mounted on the Genarco 3,000 Watt Slide Projectors and on the television background projectors sold by Telescript, Bodde, Trans-Lux. It also can be mounted on arc slide projectors such as the Strong Universal.

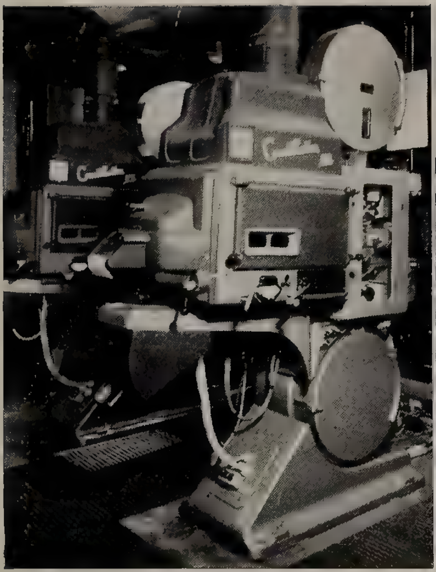
Most of these manufacturers sell the Genarco Electric Slide Changer as original equipment but it can also be adapted on slide projectors which have been delivered with manual slide changers.

BOOK REVIEWS

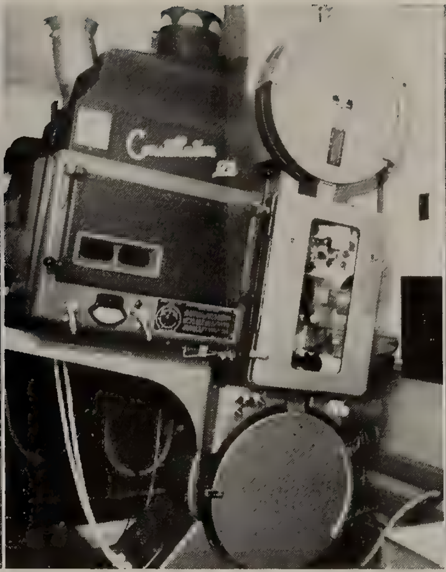
SOUND IN THE THEATRE by *Harold Burris-Meyer* and *Vincent Mallory*. Radio Magazines, Inc., Minneola, N. Y. (1959). Cloth, 8½'' x 10½'', $10.00.

In this volume the creative sound-control and effects engineer has at his fingertips the complete story on electronic sound in "live" theatrical presentations. *"Sound in the Theatre"* is the first book to set forth in authoritative detail what can be done with sound by electronic control and how to do it whenever the source—singer, actor, musician—and the audience are present together.

This outstanding comprehensive treatment of the subject of sound control is supplemented in Chapter V with 32 problems and their practical solutions. Everything from the basic equipment units and their use and installation to organization and planning are treated. The wide experience of the authors in this field is evident

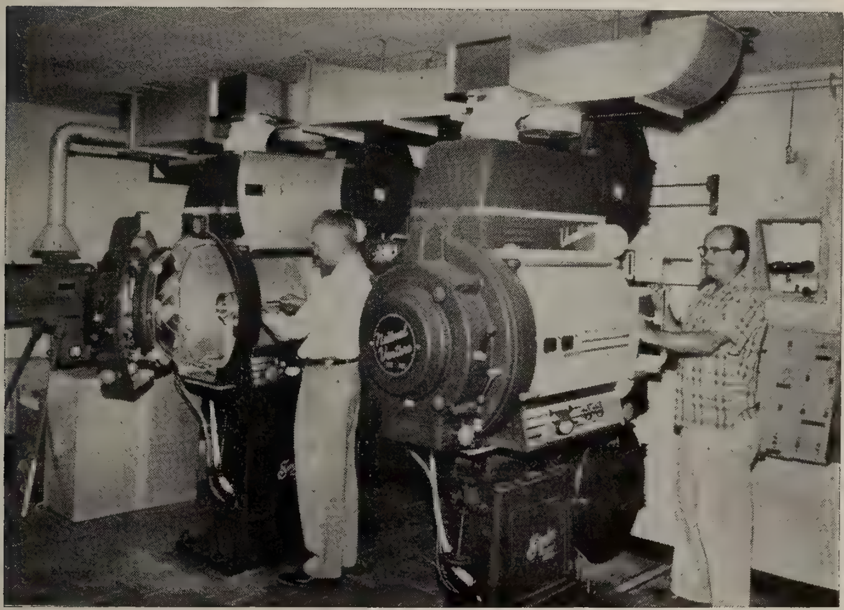


CLYDE THEATRE
Fort Wayne, Ind.
Constellations on Norelcos



STRAND THEATRE
Lexington, Ky.
Constellations on Norelcos

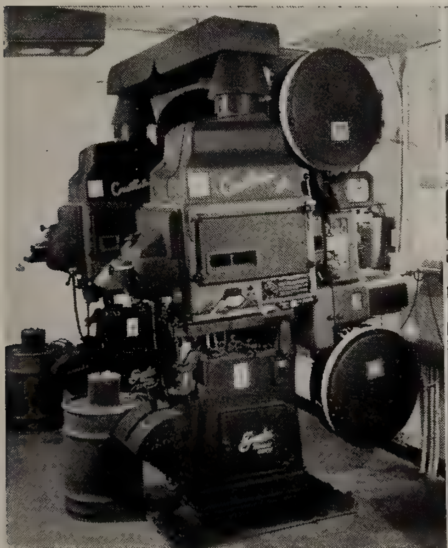
MONROE THEATRE
Rochester, N.Y.
Constellations on Norelcos



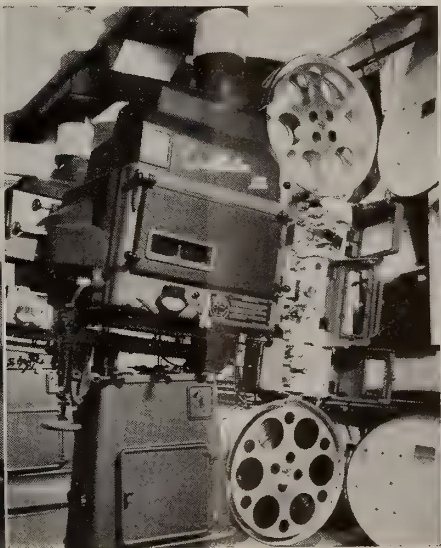
Theatre Modernization . . .

National Theatre Supply Pictures New Installations

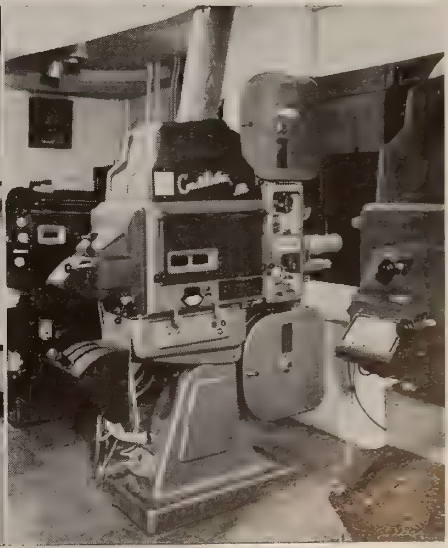
MIDWAY THEATRE
San Diego, Calif.
Ventarcs on Simplex X-L's



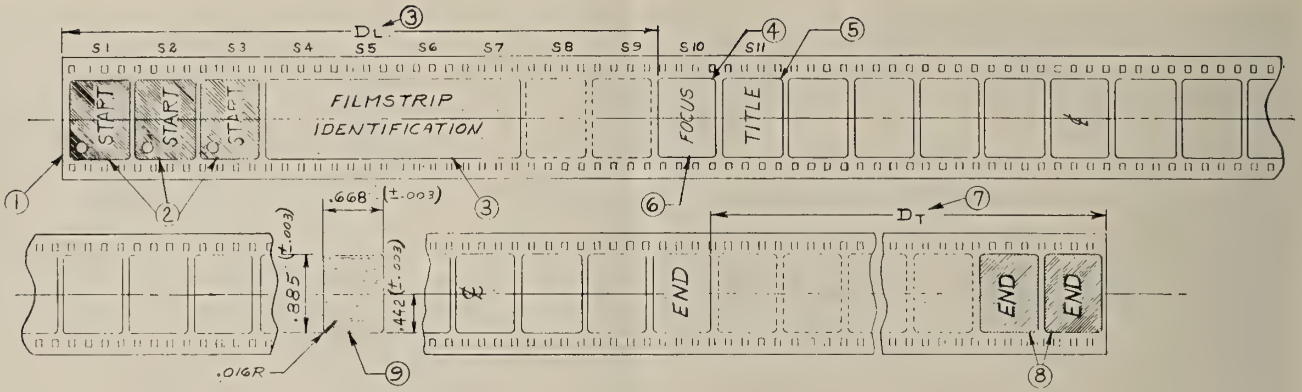
PACIFIC DRIVE-IN THEATRE
San Diego, Calif.
Constellations on Simplexes



ST. LOUIS PARK THEATRE
Minneapolis, Minn.
Constellation 170s on Century's



TOWN THEATRE
Baltimore, Md.
Constellations on Bauers



STANDARD SPECIFICATIONS

FOR 35MM SINGLE FRAME FILMSTRIPS

Purposes: The filmstrip (or slide film) with or without accompanying sound has become such an important media of communication with users spread throughout industry, commerce, religion and education that it is imperative that the arrangement of the filmstrip be standardized so that all confusion is eliminated in the actual utilization of the media.

The following items give some simple specifications that if followed by all producers of filmstrips will greatly enhance the use and therefore the value of this method of communication.

1. The trimming of the leading edge of the film shall be a straight cut located between sprocket openings and at 90°, (plus or minus 3°) with the edge of the film.

2. The first three frames (S1, S2 and S3) of the film shall have the word START in large block lettering appearing on each frame.

    2a. If color film is used the background color of S1, S2 and S3 shall be green with white lettering.

    2b. If black and white film is used the background is to be black with white lettering.

    2c. A white dot not less than 1/8'' in diameter shall appear in the upper left hand corner of frames S1, S2 and S3.

3. The distance DL from the cut leading edge of the film to the focus frame is to be no less than nine (9) frames or approximately six and three quarters (6¾'') inches. Information identifying the filmstrip may appear in frames S4, S5, S6 and S7 preferably parallel to the film edge.

4. The focus frame is located as specified by standard 3 and should contain a simple design pattern so that the projected picture can be accurately located and sharply focused on the screen.

5. The title frame (or first information frame) of the film shall be no less than the eleventh (S11) frame from the leading edge of the film.

6. If a sound medium accompanies the film a notation shall appear on the focus frame (S10) which will indicate to the operator the proper frame on which the recording is to be started.

7. The distance DL shall have a minimum length equal to the circumference of the container in which it will be stored.

8. The last two frames of the film within distance DL shall have the word END in large block lettering appearing on each frame.

    8a. If color film is used the background color of the last two frames shall be red with white lettering.

    8b. If black and white film is used the background is to be black with white lettering.

9. This specification covers the frame size and its location on the film. The frame size proportion is three to four for the nominal dimensions specified.

Viewlex Develops Filmstrip Previewer

The new Viewlex Instant 33mm Filmstrip Previewer, is announced by the Viewlex Co. It is said to be an ideal tool for salesmen and business and industry audio visual directors. It opens a new era in sales presentations. Its instant operation, light weight and large screen add the drama of a "desk-top theatre" to selling impact.

Simplicity and speed of operation are highlighted by the fact that the only working parts on the new Viewlex Previewer are the filmstrip advance knob, the focusing knob and on-off switch. Threading is virtually instantaneous by simply starting the leading edge of a filmstrip in the transport slot. It threads itself automatically as the frame advance knob is turned. A slight twist of the focusing knob brings the color or black and white image in sharp and clear on the 7''x9'' ground glass viewing screen.

The Previewer carry case is made in luggage style, with a two-tone leatherette finish. Hardly larger or heavier than a make-up kit, it measures only 4''x6''x 12'', and weighs less than 6 lb. It can be purchased at franchised Viewlex dealers complete for $59.00. Additional information is available from the Viewlex Co., Inc., 35-0- Queens Blvd., Long Island City 1, New York.

Free Film Guide Revised for 1960

The revised 1960 edition of the Pocket Guide to Free Films, a catalog of 345 movies available without charge to men's and women's clubs, fraternal societies, business and professional organizations and interested groups has just been published by Modern Talking Picture Service, Inc.

Modern Talking Picture Service distributes the films from 30 regional film libraries throughout the U. S. Copies of the new 32-page "Pocket Guide to Free Films" may be obtained without charge by writing to Modern at 3 East 54th St., New York 22, N. Y.

So the Show Smells? It May Be a New Scent Discovery!

Jokes about movies that smell are more rampant than ever, now that technology has attached scent-releasing mechanisms to the motion-picture projector. You'll not only see and hear it—you'll also smell it! And such new nostril-teasing processes as Mike Todd, Jr.'s Smell-O-Vision and Walter Reade, Jr.'s AromaRama are a far cry from the oil of neroli used many years ago during an orange-grove sequence in a film at Sid Grauman's Chinese Theatre.

AromaRama's China-produced "Behind the Great Wall" is one of the first feature-length films to smell on purpose. The synchronized scenting,, engineered by Industrial Timer, Camera Equipment, Stratonic, and perfume-maker Rhodia, is said to stink up a storm. "Behind the Great Wall" will include heady whiffs of a Hongkong street, the incense burned in a Buddhist temple, and the olefactory delights of a tiger hunt. A wide variety of other smells will be released automatically during the unreeling.

The cost of an AromaRama installation, $7,500 at present, will drop to $3,500 if the smellies gain popular acceptance, says Reade, who estimates a potential of 7,500 theatres "wired for odor."

The rival Todd process, Smell-O-Vision, made its debut at the Ritz Theatre in Los Angeles with

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TAPE RECORDINGS

(Continued from Page 15)

is a prime enemy of tape recorders.

Tapes containing recorded sound should be kept as far away as possible from magnets and all electrical apparatus, especially motors and transformers. Magnetic fields, particularly those generated by alternating currents, are capable of erasing magnetic records completely. In fact, the erase heads of recorders employ such currents to perform their function. Annoying dropouts can be produced by small permanent magnets placed near reels of tape. Tapes should therefore never be stored in cabinets having doors held by magnetic latches.

Tape Splicing and Editing

One of the several advantages of magnetic tape over disk records lies in the fact that taped sound can be edited in a variety of ways. Like a sound motion-picture film, magnetic tape may be cut, subtracted from, added to, or entirely rearranged. Errors can be excised and corrections inserted, or unwanted words in dialogue removed. The possibilities of sound-tape editing are even dangerous, for important legal testimony may be so "faked," by deleting significant words and changing the order of sentences, that the meaning is altered or even reversed from what the speaker intended. Evidence of the splices is eliminatd by the simple process of re-recording the original "butchered" tape on fresh stock.

Legitimate applications of the editing process include the shortening of unintentional pauses, the removal of accidental noises, the insertion of corrections in speech and music, and the combining of dialogue uttered at different times or by different speakers. Because the editing of tape involves cutting and splicing it, only single-track tapes can be edited unless the recorded material in the second track can be sacrificed.

Although use of a splicing block greatly facilitates the cutting and joining of magnetic tape, excellent splices can be made with nothing more than a pair of scissors and a roll of adhesive-coated splicing tape if care is taken to do a neat job. The process involves three steps:

1. Overlap the two ends to be joined and cut the two thicknesses of tape at an angle (30 degrees, 45 degrees, or 60 degrees).
2. Butt the two ends and, *shiny (base) side of the tape up,* cover the joint with a strip of splicing tape applied diagonally. Press firmly into place.
3. Trim off excess splicing tape by trimming the edges of the magnetic tape, cutting into the edges to form a very slight "waist" which precludes the possibility of splicing-tape adhesive coming off on the rollers or magnetic head.

Play the edited portion on the recording machine. If not enough tape has been removed, cut away an additional short length of tape and resplice.

All tapes containing sound records of more or less permanent value should have long identification leaders spliced to the beginning and end of the recording, and be stored on reels which are plainly marked as to content, tape speed, and playing time. The cans and boxes in which the tapes are stored should likewise be labeled for ready identification.

KINOPANORAMA

(Continued from Page 13)

ground episodes of a scene on the lower screen. On the upper screen which represents, so to speak, a part of the dome, an equal number of machines project various aspects of the skyscape and sky scenes featuring "rockets and ballistic missiles in flight, and aerial sports." The showing of a film begins with projection on the upper tier of screens followed by that on the lower. The effect produces the feeling of "you are there." The spectator sees the sky, the horizon and the ground in front of him. He feels himself a participant of events and action developing before his eyes.

The films are "shorts" of about 20 minutes' duration. The showing of a film is accompanied by stereophonic sound transmitted by 36 loudspeakers distributed at various vantage points along the perimeter of the auditorium; some of the sound track apparatus is housed in specially provided floor pits, some in apertures in the ceiling. To ensure good sound transmission, the 4300 square-foot white screen was made of special plastic material perforated with minute holes. It is the design of the screen coupled with the strategic arrangement of the loudspeaker groups that contributes so much to the quality of sound reproduction.

Whether the recorded sound is that of speech, laughter, song or symphony orchestra, the splashing of ocean waves or the roar of airplane motors it is integrated with the visual image, thus producing a complex stereophonic composition. The sound is "live," full-bodied, and well-sychronized with the action, effectively heightening every aspect of the screen presentation. The projector control panel also controls the stereophonic sound track apparatus and many other machines.

Film is Travelog Style

The first Soviet kinopanoramic sterephonic film presented was "The March of Spring." The film opens with striking scenes of racing Turkmenian horsemen celebrating the advent of spring. This is followed by an impressive panorama of Zaporozhye (in the Ukraine) factories. Next, the cameras cut across to the Caspian oil fields and present a sequence depicting the extraction of "black gold" from the bottom of the sea. The cameras move on to Leningrad and display a series of aerial shots of the great city's squares and historic buildings. Finally the "March" winds up at Moscow's Red Square, where the annual May Day parade is in full swing.

The film was produced by the Central Documentary Film Studios and the Animated Cartoon Film Studios. It was directed by Vasili Katanyan and Leonid Makhnach. The cameramen were I. Bessarabov, A. Semin, L. Atamanov, D. Babichenko and I. Ivanov-Vano.

The building of the circular Kinopanorama is 93'-4° in diameter. The auditorium, placed in the center of the building's main floor is 59 feet in diameter and has an area of 2495 square feet; its height 33 feet. Along the perimeter of the auditorium, at the first floor level, runs a foyer 14 feet wide. The foyer can also be utilized as an exhibition hall. The exterior wall of the circular foyer is of glass-framed panels running the full height of the hall. The entrance and exit doors are of frameless, transparent, specially treated, unbreakable glass.

Service Facilities Outlined

On the first floor in the back of the building are located the stairway and a number of auxiliary service rooms which have their own entrance. The projection room and its auxiliary services are located on the second floor over the foyer. The third floor contains the ventilation chambers and machinery.

The auditorium ceiling is lined with sound absorbing, aluminum-framed panels. The lighting of the auditorium and the foyer is of the indirect, luminescent type.

Architecturally, the building is simple and uncluttered by ornament. Its cylindrical shape, the lower part of which is glassed in along its entire perimeter, gives it a modern look. The upper, blank part of the wall is punctuated by small rhythmically spotted apertures which form an attractive pattern of grilles for the intake ducts of the ventilation system. The building, 34'-8" high, is crowned with a large gas-lighted sign "Krugovaya Kinopanorama."

The theatre was planned and designed by studio No. 13 of the Mosproekt Institute. The authors of the project are N. Strigalov, architect, and G. Muratov, engineer. Vladimir Kotov of the Cinephoto Research Institute was in charge of the cinematographic equipment installation. The actual construction took a little more than three months. Equipment and machinery were manufactured by plants in Moscow, Leningrad, Kiev, Samarkand, and Odessa.

* * *

New Carbon Saver Developed by Walters

DALLAS, TEXAS — A new carbon saver for rotating type lamphouses has been developed by Lou Walters, local service for motion picture projector repair and development. No tools are said to be required, and the low price of the carbon savers allows three to be used in each projection room, allowing time for cooling between use.

Working projectionists have been pleased with the saver, Mr. Walters says, because there is no drilling or other difficulty — the crater end of the carbon stub is merely inserted into the special reamed extension, allowing more time for the otherwise-wasted stub.

SCENT-MOVIES

(Continued from Page 19)

"Scent of Mystery." This is a $2,000,000 spectacular on Todd-AO 70-mm film replete with more than 50 odors and 8-channel stereophonic sound. "Scent of Mystery" is a comedy-mystery thriller shot in Spain and starring Paul Lukas, Deholm Elliott, Peter Lorre, Diana Dors, and Beverly Bentley. Smells will be used for atomsphere, as cluses to the mystery, and as "whiff-gags" to trigger laughter.

A bit terrifying to comtemplate is an equipment malfunction which would accidentally release 50 or more odors all at once in full strength—audiences would then require the old "de-skunking" treatment of semi-interment for seven days. That is, if they weren't asphyxiated by a full dose of Oriental gardens, rainy-day subway smells, foo-yong aromas, and the stench of a paper mill!

Only the filmgoer's nose knows how audiences will react to the odor spectaculars.

WHAT'S YOUR C.I.Q.?*

TAKE THIS SIMPLE TEST TO FIND OUT

KNOWING THE CORRECT ANSWERS TO QUESTIONS ABOUT CANCER COULD SAVE YOUR LIFE

		TRUE	FALSE
1	Leukemia is cancer of the blood-forming tissues.		
2	All forms of life, including plants, can develop cancer.		
3	Cancer is not contagious.		
4	More men than women die of cancer.		
5	Pain is a late cancer symptom.		
6	Cancer can strike anyone at any age.		
7	A biopsy (examination of suspected tissue removed from the body) is the only method of proving whether cancer is present.		
8	Surgery or irradiation, or both, are the only means of curing cancer.		
9	An annual health checkup is one of the most effective weapons against cancer.		
10	Over one million Americans are alive today, cured of cancer.		

SCORING: 10: Excellent
6 to 9: Fair
5 or less: Danger! For your own protection, learn more about cancer. Write to "Cancer" —c/o your local post office.

AMERICAN CANCER SOCIETY

ANSWERS: ALL TEN OF THESE STATEMENTS ABOUT CANCER ARE TRUE.

*CANCER INTELLIGENCE QUOTIENT

MONTHLY CHAT
(Continued from Page 3)

objects as much as possible, and thus "fool" the eyes of viewers into a better illusion of smooth movement. A much better solution of the motion-flicker problem requires shooting and projecting, not at 24, but at 30, frames per second. But the projectors in most TV studios are unfortunately geared for 24-frame reproduction only!

There is no question about the benefits of a 30-frame/second rate in theatre projection: The real problem is to convince the studios and equipment manufacturers that such a change would produce an immediate and startling improvement in the natural lifelikeness of motion pictures. Motion flicker would be tremendously reduced, and shutter flicker would henceforth be a thing of the past, no matter how bright the picture. Nor are these the only benefits. With an increase of 35-mm film travel from 90 to 112 feet per minute, the film-buckling effects of heat would be reduced, focus would be improved, and the frequency-range of the sound reproduction somewhat extended. This is a proposal worthy of serious thought.

* * *

J. R. JOHNSTONE NAMED

NEW YORK—J. R. Johnstone has been appointed administrative assistant in the office of Wm. H. Feathers, president of National Carbon Co., Division of Union Carbide Corp. Mr. Johnstone joined National Carbon in 1937 as a member of the industrial sales department. His most recent position was marketing manager for carbon products.

High Speed Photo Congress Set for Washington Oct. 16-22

NEW YORK — 'The scope of the Fifth International Congress on High Speed Photography will include a survey of various fields of the sciences now using high speed photography as a basic tool in research and development and an exploration of new applications and techniques,'' congress chairman Max D. Beard said here.

The congress is scheduled to take place Oct. 16-22 at the Sheraton Park Hotel in Washington, D. C., under the sponsorship of the Society of Motion Picture and Television Engineers.

Equipment and instrumentation designs representing new basic principles in mechanics and optics are now being developed for their initial presentation at the congress.

The SMPTE in 1952, cognizant of the rising technological values of photographic instrumentation, sponsored the first high speed congress in Washington, D. C. Subsequent congresses have been held in Paris, London and Cologne, West Germany.

* * *

Projection Pointer

The Ednalite Optical Co. of Peekskill, N. Y., a pioneer research and manufacturing firm in the fields of precision optics and audio visual instruments, is releasing the Ednalite electric projection pointer for regular commercial sale.

The Ednalite pointer, with a press of a button, casts a brilliant, sharply defined, non-spilling, contrasting arrow image over long projection distances. It is said to be the perfect instrument for lecturers who must clearly indicate specific points of discussion on slides or charts for group meetings, even in fully lighted arena or auditorium-sized locations.

Pointer operates on ordinary 115 volt AC house current in conjunction with a 7 volt A.C. transformer so compact that it's built into the carry case. 15 feet of detachable line cord are supplied with the unit. The complete projection pointer system may be purchased for $69.50 direct from the Ednalite Optical Company, Inc., 220 N. Water Street, Peekskill, N. Y., or through scientific instrument, visual education or photo equipment dealers.

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EAST COAST OFFICE
545 Fifth Avenue
New York 17, N.Y.
Murray Hill 7-7746
RAY GALLO
General Manager

MIDWEST OFFICE
Tenth Floor Upper Midwest Bldg.
Minneapolis 1, Minn.

FRANK W. COOLEY, JR.
Editor and Publisher

R. ENTRACHT
Associate Publisher

RAY GALLO
General Manager

R. A. MITCHELL
Technical Editor

In this issue . . .

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MONTHLY CHAT

The Many Faces of Pay-TV

LIKE THE DEVIL, himself, toll-TV assumes many guises. When the ill-fated Bartlesville, Oklahoma "Tele-Movie" fiasco faded from view, the ogre reappeared in Toronto as the Paramount-sponsored "Telemeter" coin-box method of making the stay-at-homes cough up a dollar per peek at a movie (not first-run!) shown on their own TV sets. Even though most home TV sets are allowed to get out of adjustment, making the pictures look worse than Edison's peep-show flickers, plans are afoot to hike the fee for home tube-viewing.

Is this bad? For "free" television, yes; for theatre movies, no. The tiresome inanities and irritating commercials of free-TV cannot long compete *in the home* with anything, even Mary Pickford shown *sans* "important messages" of requent occurrence. But what is a modern feature movie without good color, the panoramic CinemaScope screen, realistic sound, and the relaxing atmosphere of the theatre? Movies on the home picture-tube are tiny gray things that are truly pitiful in their dramatic impotence.

There are many different systems of toll-TV, and their proponents promise fee-paying viewers first-run movies, sports events, variety entertainment, and educational courses (the last three already available for free on commercial television). But hell is paved with good intentions! It is unlikely that pay-TV, having succeeded in pushing free-TV off the air for good, will persist in a diet of first-rate fare. The movies will get older, the broadcasting more sloppy, and the cheapness of 16mm gradually substituted for the quality of 35mm. In a very short time the public will be paying for TV programs it now gets for nothing.

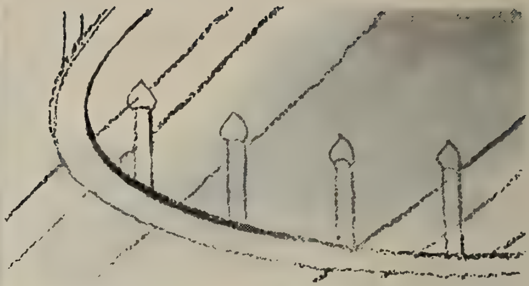
The Paramount Telemeter system initiated February 26 in the Toronto area employs coin boxes attached to the user's TV set and the regular telephone wires, not the airwaves, for transmission. In this respect it resembles the Bartlesville Tele-Movie subscription system. Paramount met with the same enthusiastic reception that greeted the Bartlesville bungle three years ago; the subscribers number thousands; and their eagerness to drop dollars into the coin boxes to escape the unimaginative, hackneyed, mind-dulling crap issued in endless torrents by free-TV is very understandable. But human nature being what it is, and the limitations of TV transmission being what they are, toll-TV appears doomed by the equally understandable urge to escape from too-familiar surroundings and enjoy a well-presented movie on a giant screen in the glamorous atmosphere of the theatre .

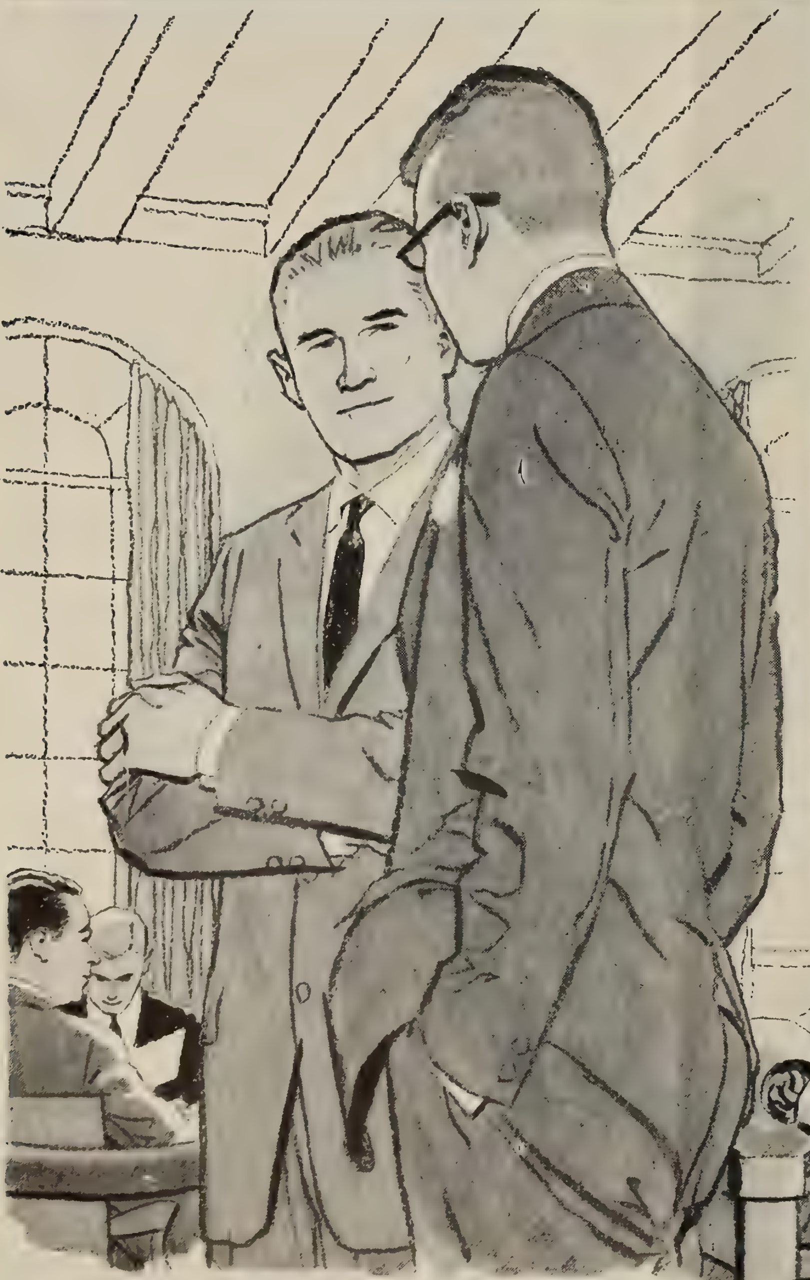
Radio-TV critic Harriet van Horne stated the case admirably a few years ago:

"When I see a movie, I like to see it in a movie house, dark, hushed, and insulated from reality. You can't get involved with the characters and their conflicts on television. The size of the home screen, . . . the ringing of the telephone, . . . the impulse

(Continued on Page 10)

"When we talked about the Plan person-to-person, participation jumped 30%!"



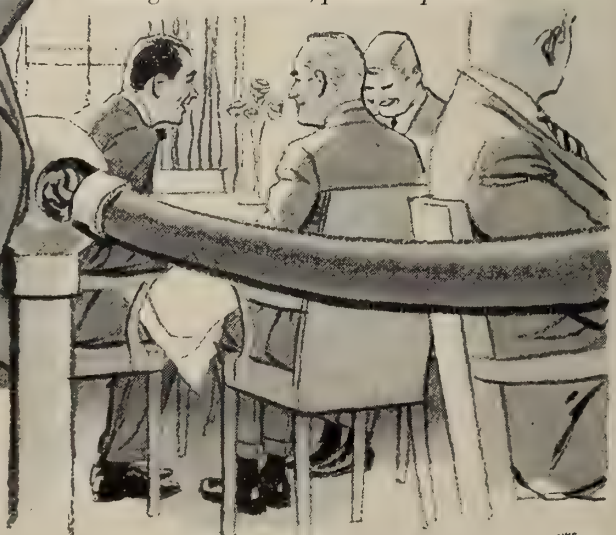


In our company we've made the Payroll Savings Plan available for some time. I thought, naturally, that we had a large participation. But when I checked up a few weeks ago I discovered that only about 22% of our people were making use of the Plan. It's so easy to say, "Sure, this is a fine idea, and I'll sign up next payday."

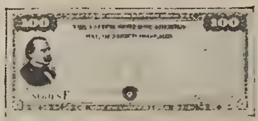
What our people needed was someone to explain this convenient savings plan *in person;* someone to show them that just signing the card would put this fine thrift program into automatic operation. They needed somebody to invite them to *start right now.*

When I contacted our State Savings Bonds Director, he helped us set up a thorough, informative canvass of everybody on our staff. As a result more than 30% additional employees signed up for this easy, systematic way to buy U.S. Savings Bonds, *regularly.*

Perhaps *your* organization, too, has a large percentage of employees who have *never been invited* to combine patriotism with basic thrift through the Payroll Savings Plan. Companies with high employee participation are enthusiastic about its benefits in terms of lower employee turnover, better safety records, and the satisfaction engendered by helping large numbers to contribute to our Nation's Peace Power. The greater your employee participation, the more substantial your company benefits will be. Contact your State Savings Bonds Director for prompt, practical help in spreading Payroll Savings information, *person-to-person.*



NOW! U. S. SAVINGS BONDS EARN 3¾%



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INTERNATIONAL PROJECTIONIST

Volume 35 April 1960 Number 4

Large-Area Frames and Picture Quality

By Robert A. Mitchell

PART II

Which of the current large frame negative processes gives the best screen image? Mr. Mitchell's definite answer indicates that the print, itself, dictates the choice of process —VistaVision or PanaVision or Technirama or Cinemascope. This article will inspire arguments aplenty; but you can be sure that wide-gauge prints are holding their own on giant screens!

THE RESULTANT image quality of 35-mm projection prints (grain & resolution) is known to be inversely proportional to the overall magnification from negative frame to screen image. The quality of the photographic image on the negative is all-important; and, of course, the larger the negative, the better the picture on the screen *regardless of the size of the frames on the positive print.* In other words, a "large-area" negative will give the *same* high picture quality on the screen whether we project a 70-mm contact print or a 35-mm reduction print.

This proposition is strictly true only from the point of view of photographic and optical considerations alone, otherwise we should be using inexpensive 8-mm prints for theatre showings. The projection process involves physical factors such as illumination efficiency and accuracy of the optical line-up. These factors become less severely limiting as the size of the film aperure is increased. Although it is possible to project a picture of moderate size from 16-mm film by using carbon arcs, all small-film systems are necessarily less efficient than 35-mm systems, and 35-mm projectors are somewhat less efficient than 70-mm projectors. Even if lamps of sufficiently high power were available, any attempt to project 8-mm or 16-mm prints upon giant-size theatre screens would result in burning up the film!

We may therefore rightly expect to get better screen results from wide-gauge prints, especially if the screen be much wider than about 30 ft. As is well known, light and heat problems assume major importance in 35-mm projection when the screen stretches 50, 60, or even more than 100 ft. from one side to the other in drive-ins and large indoor theatres. But if the screen be under 30 ft. in width, it is only the area of the frames photographed on the original negative that influences the resolution, or definition, of the images. It would be virtually impossible, in such situations, to perceive on the screen any difference in the qualities of 35-mm and 70-mm prints made from the same negative.

Image-Quality Factors

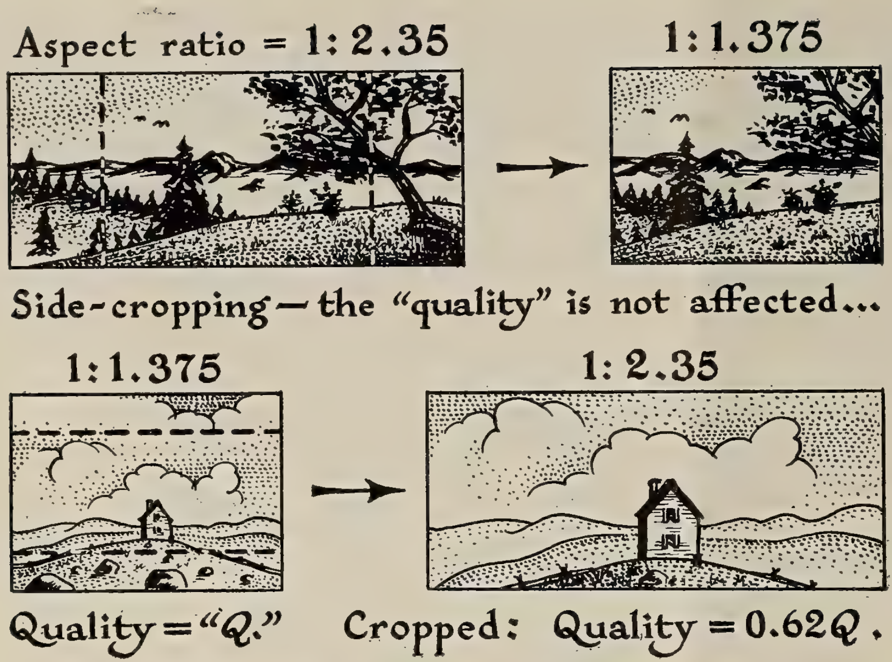
Unless anamorphosis be involved (as in CinemaScope and Technirama), the relative image qualities of negative frames of various sizes are directly related to their relative "projectable," — or usable — heights. If "Negative A" has frames which are twice as tall as the frames on "Negative B," the pictures obtained from Negative A will have twice the image quality of those from Negative B, providing the emulsions are identical (the same grain size, the same amount of dye-bleeding if color negative, etc.). Now, this is true even when both negatives, A and B, are reduced by optical printing to positive frames of the same size!

If we "squeeze" the images by means of an anamorphic lens, however, we unavoidably reduce image quality in the direction of the squeeze—in CinemaScope, the horizontal dimension. A "2-times squeeze" (an anamorphic factor of 2X) cuts the image quality in half because the horizontal dimension has to be magnified twice as much in projection as the vertical dimension! This means that the CinemaScope projection-lens attachment doubles graininess and other negative defects in the horizontal dimension, but not in the vertical.

The "overall quality" of an anamorphic picture is determined by assigning numerical values to the separate vertical and horizontal "qualities" and averaging them.

Reason For Large Negatives

The height of the projector aperture is just as important as the height of the negative frame in regard to image quality on the screen. Suppose that the standard 35-mm aperture in a 35-mm projector is replaced by an aperture of the size used in 16-mm



The side-areas of a picture may be removed without loss of image quality if the full original height is utilized. If, however, the height of a picture is "cropped" to increase the aspect ratio, quality (photographic resolution) is lost. The resultant quality (Q) is determined by dividing the final height of the picture by its original height.

projectors. Even though the film is 35-mm, the pictures on the screen will have a quality no greater than 16-mm quality, providing that the lens is also replaced to maintain the same size of screen image. The "cropped" apertures employed for non-anamorphic widescreen projection reduce picture quality in exactly the same way.

Now suppose that two motion-picture cameras are set up to photograph the same picture, one a regular 35-mm camera and the other a 16-mm camera. If the image quality of the 35-mm negative is denoted by 1, or the letter Q, then the quality of the 16-mm negative will be only 0.47Q—approximately one-half of the 35-mm quality. This is because the 16-mm frame is only about half as high as the 35-mm frame. *But if the 35-mm negative be reduction printed on 16-mm film, the resulting 16-mm print will have nearly the same image quality as a 35-mm print.*

The preservation of negative quality in the fine-grain positive print is the reason why professional motion-picture producers are more frequently using large-area negatives from which the standard 35-mm release prints are made by reduction printing.

"Q" Tells The Story

A comparison of the relative image qualities of the commonly used motion-picture systems reveals many interesting facts and dispels much of the mystery created by conflicting claims. And to make these comparisons easy to appreciate, we shall employ Q as a "unity-quality" norm to denote the image quality of standard 35-mm films printed from regular 35-mm negatives and projected with the Academy aperture of 1:1.375 aspect ratio (.600" x .825").

Let's examine the non-anamorphic widescreen projection methods first. These are very simple processes, inasmuch as they involve nothing more than "cropped" apertures and short-focus lenses to obtain widescreen images from regular prints. The two most widely used aspect ratios, 1.1:65 and 1:1.85, require projector apertures of standard width (.825") but less-than-standard height (.501" and .447", respectively).

Simple computation reveals that a print made for the conventional Academy aspect ratio of 1:1.375 suffers great quality losses when shown *via* height-cropping apertures and wide-angle lenses. If the quality is Q (or 1) at the conventional aspect ratio, it drops to 0.84Q at 1:1.65 and to 0.75Q at the more popular 1:1.85 ratio—only 75 per cent as clear and sharp as "conventional - screen" pictures projected from the same film!

The Paramount "VistaVision" process of photography and printing represents the most successful attempt to increase the resolution of the image *on the regular type of 35-mm release print.* VistaVision has more than sufficient sharpness to give a high-resolution image when shown at all widescreen aspect ratios up to 1:2 (although picture-illumination considerations limit the aspect ratio of nonanamorphic 35-mm to a maximum ratio of 1:1.85).

The "secret" of VistaVision is its large-area negative frames which reduce the effect of grain and increase resolution. Standard 35-mm negative is used, but it passes through the camera *horizontally* to give "8-hole" frames having approximately twice the area of conventional "4-hole" frames.

There are two types of VistaVision negative frame. One is a double-frame area with a 1/10-inch soundtrack strip masked off along the top of the pictures for "horizontal VistaVision" contact prints which may be shown with a special projector at aspect ratios from about 1:2 down to 1:1.71 (projector aperture .825" x 1.418"). The picture has a quality index of 1.38Q. that is, 1.38 times the standard. This type of VistaVision negative is not much used because horizontal 35-mm projectors have been displaced from favor by the more versatile combination 35-and-70 millimeter machines.

The usual type of VistaVision negative has a full double-frame picture area without a soundtrack. This is suitable for horizontal projection with a 1:1.65 aspect-ratio aperture measuring .860" x 1.418", but it is ordinarily used exclusively for making non-anamorphic 35-mm reduction prints for theatre release. This full-frame VistaVision negative has the highest quality of any non-anamorphic system now in use, namely, 1.43Q.

This high image quality is preserved in the "vertical" VistaVision reduction print if the same aspect ratio (1:1.65) is maintained. Such a print has rather wide framelines, as all projectionists know; but it can be projected with a 1:1.65 widescreen aperture (.501" x .825") without loss of image area or image quality. The quality drops to 1.28Q when the VistaVision print is projected with a 1:1.85 aperture (.447" x .825"), but this more panoramic aspect ra-

tio is preferred, and 1.28Q is still appreciably better than the quality of non-anamorphic prints derived from other processes, including 65-mm film, when cropped to the 1:1.85 ratio in the projector.

It has often been asked why VistaVision reduction prints do not utilize the entire Academy-frame area so that they may be shown at the conventional 1:1.375 ratio without revealing portions of the framelines on the screen. Such an expedient would introduce minor quality losses. If a VistaVision print of this type were shown at 1:1.65, the quality would be 1.19Q; at 1:1.85, 1.07Q. (But even these slightly lower qualities are acceptably good!)

VistaVision nevertheless does not fare as well as either Technirama or Panavision (65-mm) when it comes to making CinemaScope release prints. Because the maximum aspect ratio of the VistaVision image is 1:1.65, the production of a CinemaScope-type picture having an aspect ratio of 1:2.35 requires severe cropping of this image. This can be done, and the resulting picture enlarged slightly in the vertical dimension* and compressed to half its width by anamorphosis; but the resulting 35-mm CinemaScope print has a quality index of only 1.01Q. This is practically the same as the quality of the conventional Academy-frame 35-mm picture which has been with us for years, and though it may not be high enough to suit all critics, it is undeniably very much better than the CinemaScope images photographed by a conventional 35-mm camera having an anamorphic attachment over the lens.

C'Scope Needs Large Negative

The quality index of "conventionally" filmed CinemaScope pictures is almost too low to be tolerated. Because the CinemaScope projector aperture (.715" x .839") has a height greater than that of a standard Academy aperture (.600" x .825"), the image quality of the *vertical dimension* of CinemaScope is higher than the norm,

*It may seem strange to speak of **enlarging** the big VistaVision negative frame to obtain a 35-mm release print! But after the VV image has been cropped to the CinemaScope aspect ratio of 1:2.35, its projectable area has a height of only .603". The 35-mm C'Scope projector aperture is .715" high. Thus the negative image must be slightly enlarged (while it is being squeezed horizontally by an anamorphic lens) to get exactly the right size of frame for the 35-mm print.

Altenbach Appointed to Production Post

TOLEDO—Arthur Hatch, president of the Strong Electric Corp., has announced the naming of Leo A. Altenbach as a vice-president in charge of production. Altenbach has been with the Strong Electric Corp. since 1927, starting as a mechanic. He was the eighth person to be employed by the Strong Co. He has been plant superintendent in recent years.

Altenbach

Electro Carbons Develops Series of King - Size Carbons

CHICAGO, ILL. — The development of a "king size" series of projection carbons has resulted in savings up to 46%, according to Lee Artoe, president of Electro-Carbons, here.

The king size 18 in. carbon is especially built for the Brenkert lamphouse; there is also a "giant size" 20 in. carbon designed for the Peerless Magnare and the Strong Mogul lamphouses. A king size negative carbon 12 in. long can be used for all lamphouses.

The use of the giant size positive is said to cut stubs 46% per 1,000 in. of burning, or a savings of 15% of the total cost, figuring a 4 in. average stub. The extra long lengths are available only in the 7 mm., 8 mm. and 9 mm positive sizes, Mr. Artoe points out.

Specific tests are cited by Electro Carbons to show that the 8 mm. by 20 in. carbon, burning at a rate of 3⅝ in. per 20-minute reel, will provide five reels per carbon with a 2 in. stub for a cost of 13.8 cents per hour of operation.

(Continued from Page 7)
namely, .715/.600 equal 1.19Q. However, the 2X expansion of the horizontal dimension by the anamorphic lens virtually halves the horizontal quality (.839/.825) x $\frac{1}{2}$ equal 0.51Q. The overall quality of CinemaScope photographed on 35-mm negative is accordingly the average of these two values, or only 0.85Q.

Conventional non-anamorphic films projected at an aspect ratio of 1:1.65 have about the same index of quality (0.84Q), but, of course, CinemaScope has the advantages of a greater aspect ratio (1.2.35) and a larger frame area —a brighter picure and less severe buckling effects on the screen because of the longer focal length of the "prime" lens.

VistaVision negatives, we have seen, are capable of yielding CinemaScope prints of about unity quality. Image qualities greater than Q can be obtained if the CinemaScope prints are derived from Technirama and Panavision negatives. Let's examine the Technirama process first, noting its unique characteristics.

Technirama a Hybrid Process

Like VistaVision, Technirama employs a horizontally oriented 35-mm negative in a camera having an 8-hole intermittent shift. Each frame of Technirama has the same area as the type of VistaVision negative frame with 1/10 inch masked off along the top of the pictures for the soundtrack. But unlike VistaVision, a completely non-anamorphic process, the Technirama camera utilizes a special anamorphic attachment which produces a 1.5X image squeeze on the film—less, it may be remarked, than the 2X squeeze effected by a CinemaScope anamorphic lens.

A contact print made from the double-frame Technirama negative can be shown in a "horizontal" 35-mm projector of the type designed for horizontal VistaVision, providing that an anamorphic attachment which expands the horizontal dimension of the image $1\frac{1}{2}$ times is placed over the lens. With a projector aperture measuring .825" x 1.418"— an aperture resulting in an aspect ratio of 1:1.71 with horizontal VistaVision, —the Technirama picture has an aspect ratio of 1:2.56. But Technirama negative is intended mainly for optical printing and Technicolor processing to yield (1) conventional non-anamorphic 35-mm prints, (2) 35-mm CinemaScope prints, or (3) 70-mm Panavision-type prints, whichever is desired by the producer of the picture.

The image quality of all these prints is uniformly 1.15Q, except in the case of non-anamorphic 35-mm prints cropped in projection. An "Academy-aperture" print (1:1.375 aspect ratio) projected with a 1:1.65 aperture has a quality of 0.96Q, or as low as 0.86Q if shown with a 1:1.85 aperture. If the print has been made to give the maximum quality of 1.15Q at the 1:1.65 ratio, projection at 1:1.85 reduces the quality to 1.03Q, or about equal to the standard "small-screen" norm.

The conclusion is inescapable. Technirama is a superior process for the production of CinemaScope-type prints, but perceptibly inferior to VistaVision for standard non-anamorphic release prints.

Versitility of Technirama

To make conventional prints from Technirama negative, the image must be optically reduced and "de-anamorphosed" by a factor of 1.5X. Large areas must be discarded from the sides of the 1:2.56 picture, but this does not reduce quality because no cropping of the vertical dimension is required.

Panavision 70-mm prints may be made by a similar process: the images unsqueezed and reduced *very slightly*. (The Technirama *camera* aperture is approximately .868" high, while the 70-mm *projector* aperture is .808" high.) Horizontal cropping, which reduces the original aspect ratio of 1:2.56 to 1:2.35, is obviously very slight.

The manufacture of CinemaScope prints from Technirama negative requires the introduction of additional anamorphosis. Because the Technirama negative image is squeezed by a factor of 1.5X, an additional squeeze of 1.333X is produced by an anamorphic lens in the optical printer to provide the overall anamorphic factor of 2X employed by CinemaScope. (1.5 x 1.333 . . . equal 2.) And with these prints the maximum Technirama picture quality of 1.15Q is best realized by users of 35-mm projectors.

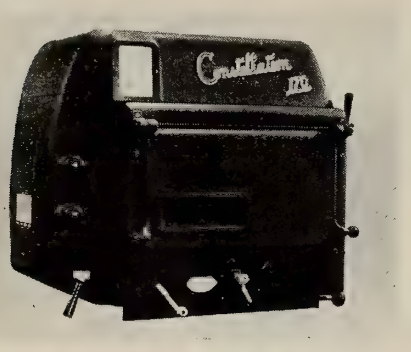
Only a few words need be said about "CinemaScope-55," so named because 55-mm negative film is exposed in a special camera. Ex-

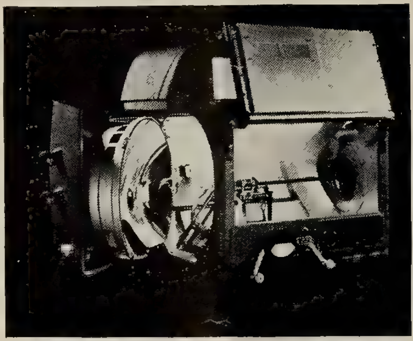
(Continued on Page 17)

Arc Lamp Has Novel Features

A ventilating system which is said to attain a new high in efficiency and a water cooled carbon contact that promises to be practically trouble-free, are features of the new 1960 model Constellation projection arc lamp just announced by National Theatre Supply.

Designed for quick adaptability to the projection of both 35 mm and 70 mm film widths the new 165 ampere Constellation utilizes 70 per cent more air to keep the entire lamphouse assembly at least 30 degrees cooler than other lamps, the manufacturer points out. The complete change of air effected twelve times a minute, instantly withdraws any





smoke and soot which heretofore would have settled on the mirror. A volume of air 100 per cent greater than that of previous lamps reduces thermal stresses that could cause reflector failure, it is claimed.

Height of the new Constellation is reduced by 25 per cent, and there is no need of revamping existing exhaust systems which have worked efficiently with arc operating at 90 amperes or above.

The new Flow-Tite water cooled heavy duty pure silver carbon contact, standard equipment, is of greatly simplified design employing a fully enclosed single piece water conducting tube for each contact requiring no water connections at the carbon contact, and no flexible conduit or welded or clamped joints which might be subject to breakage or leakage.

The spot is shaped to the exact dimensions of the aperture by means of a light expander lens which makes for much greater screen lighting efficiency.

Accommodating a full 20-inch trim of 13.6 positive carbon, the Constellation can project one double reel of film more than can be run on lamps which cannot accommodate this economical trim. The feed control can be set to burn the desired number of inches of carbon per hour from 7 to 22. Both carbons are advanced as they are consumed by means of separate Bodine geared head motors which are controlled by a single adjustment, the manufacturer says.

The integrated automatic arc position control system maintains a uniform arc gap length with the crater accurately held at the focal point of the mirror.

Without constant attention from the projectionist a screen light of constant intensity and color is automatically maintained and the arc can be shifted for the quality of screen light desired without disturbing the relative carbon positions or the equilibrium of the arc.

The rear door swings out of the way to facilitate retrimming and permits easy cleaning of the lamphouse and integrated reflector.

Literature on the 1960 Constellation is available from any National Theatre Supply Branch.

National Carbon Issues Another Projection Booklet

"The Optics of Projection", an instructive booklet of interest to projectionists, has been released by the National Carbon Co.

It deals, as the title implies, with support the clearly-written text lenses, light, film, magnification, convergence, mirrors and other vital technical data intended to provide a better understanding of the science of projection.

The booklet is available from the National Carbon Co., 30 E. 42nd St., New York 17, N. Y.

LETTERS TO THE EDITOR

(Continued from Page 11)

IP's mailbag in a long, long time. And no wonder! Mr. Jackson is a knowledgeable projectionist and an engineer of considerable note—he is the inventor of the oscillating-cam intermittent movement widely used in 35-mm TV projectors, as well as an improved "continuous" projector which shows promise of relegating the conventional intermittent-and-shutter construction to the antique shop.

We believe that every projectionist should make a projection-angle gage of the type described by Mr. Jackson. If bakelite or masonite is used instead of plywood, and a steel rod for the pointer instead of wire, the extra time required for its manufacture will be well spent. Relief projectionists who travel frequently from theatre to theatre will find this gadget a necessity.

Got some favorite kink or gadget of your own? Write us about it and share it with the craft.

MONTHLY CHAT

(Continued from Page 3)

to tidy the living room during the dull spots, and the fact that you are watching in your own busy, familiar home make it impossible to become absorbed in a movie. Rarely does a TV film take you out of yourself and into its own world.

"Rarely, afer watching a movie on television, does the viewer long to discuss it with others. It's out of sight and out of mind, just like that. So complete is one's absorption in a theatre, however, that it's sometimes a jolt to find out that the picture is over."

Unlike a Chicago theatre magnate who predicted in 1957 that "all major Hollywood studios engaged in the production of motion pictures for theatres will close within the next six months," IP expects the motion-picture theatre to be with us for a long, long time, ever growing and expanding and maturing as it continues to fulfill its unique and necessary function in the life of the people.—R. A. M.

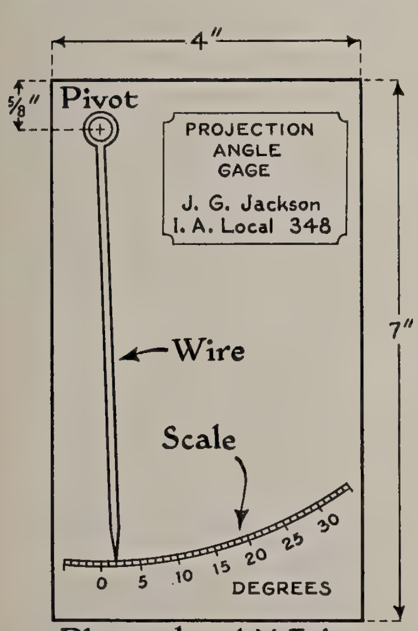
LETTERS TO THE EDITOR

Editor, IP:

After reading R. A. Mitchell's worthwhile article in the February issue anent projection angles, this question comes to mind: How many projectionists know what the projection angle is in their theatres? The writer guesses that the number is very small.

The accompanying drawing shows a simple projection-angle gage that any projectionist can make in a few minutes. It is simply a 4 in. by 7 in. piece of plywood with the two long sides perfectly parallel. A straight wire pointer is suspended on a pivot (a small nail or screw) near the top left-hand corner with a loose fit so the wire can move freely. At the bottom is shown a scale marked off in degrees, *with Zero being exactly the same distance from the side as the pivot.* (This is important.) Use a protractor to mark the divisions of the scale accurately.

Test the gage by placing the side against a door frame or wall known to be plumb, or test with a spirit level if one is handy. The pointer should then read Zero. If it doesn't, bend the wire slightly until it does.



Plywood, 4 X 7 in.

ANGLE GAGE—This is the Jackson projection angle gage discussed above. The two long sides must be perfectly parallel, and the pivot-Zero line exactly perpendicular...

To measure the projection angle in indoor theatres, simply set the *left hand* side of the gage against the end of the lens barrel. The pointer will then indicate the exact projection angle. For use in drive-ins where the angle is up, place the *right-hand* side of the gage against the lens barrel.

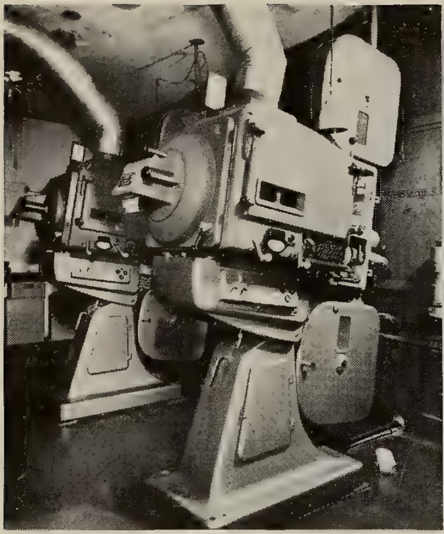
In the event that the screen is tilted, and it is desired to know the *effective* projection angle, measure the amount of screen-tilt by placing the side of the gage against the screen frame. Subtract this reading from that taken from the projector lens to get the effective projection angle.

J. G. JACKSON
Port Alberni, B. C.
(I. A. Local 348)

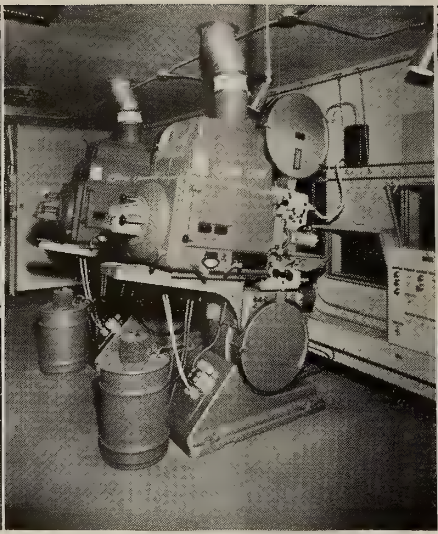
Editor's Comments

The foregoing is one of the best projection "kinks" to pop out of

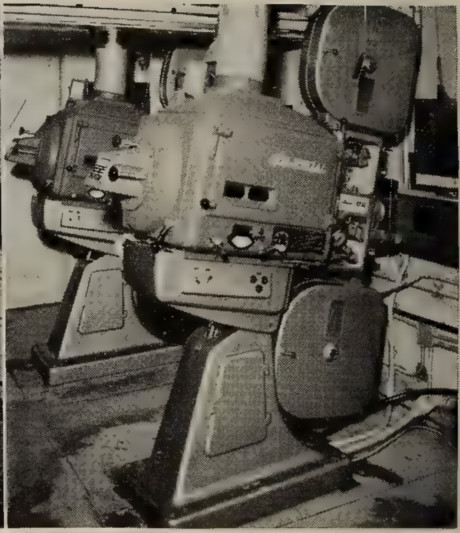
(Continued on Page 10)



PARAMOUNT THEATRE
Edmonton, Alberta, Canada
35/70 Specials on Bauers



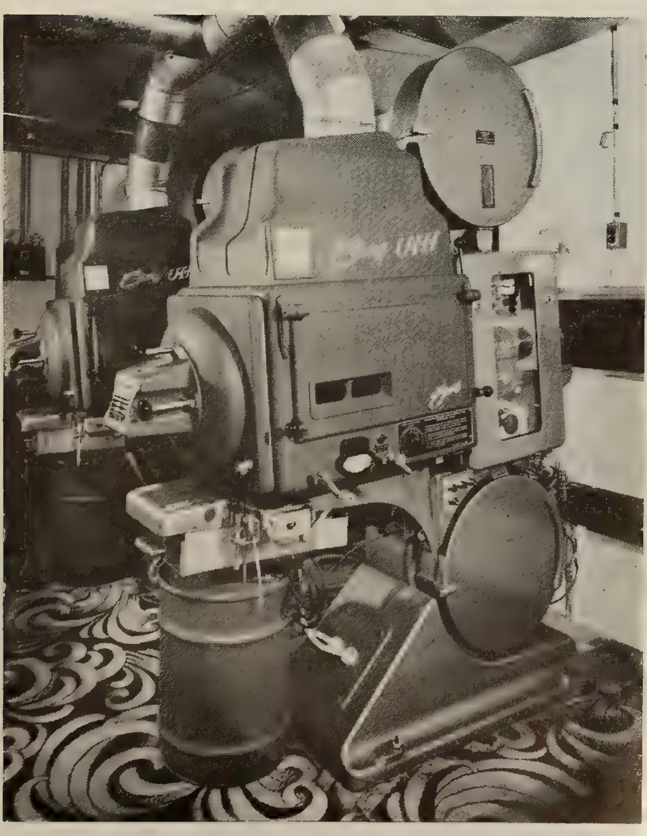
COOPER THEATRE
Omaha, Nebraska
UHI's on Norelcos



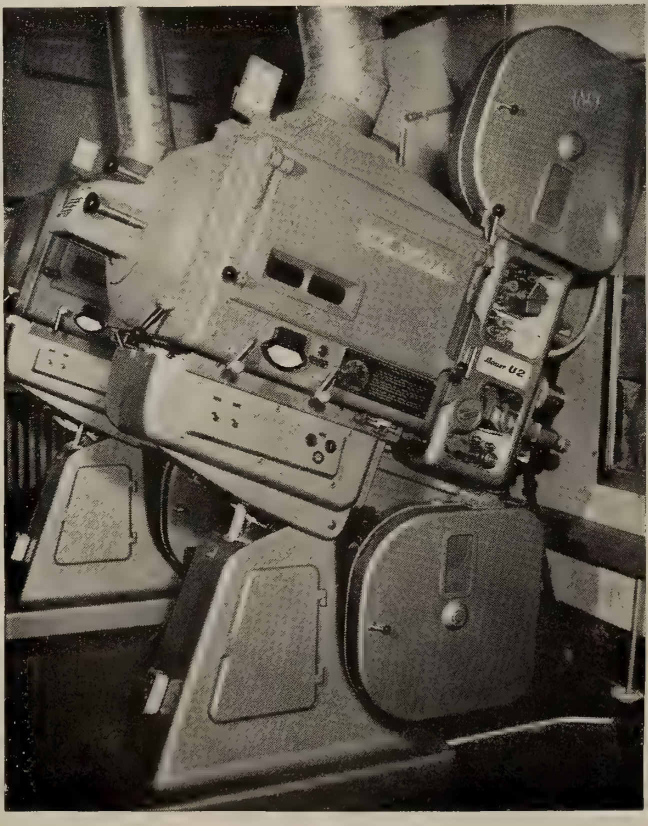
CAPITOL THEATRE
Calgary, Alberta, Canada
35/70 Specials on Bauers

Strong Electric Corp. Lamp Installations Follow Trend to Combination Set-Ups

Shown in these illustrations are several new installations using Strong 35/70 Specials for the presentation of 70-mm productions as well as the standard film widths. Installations on Bauers and Norelcos are illustrated.



CAPRI THEATRE
Kansas City, Mo.
Strong UHI's on Norelcos



CENTER THEATRE
Fall River, Mass.
35/70s on Bauers

Attraction, In Traction

An extreme example of both sides following through in the line of duty is shown above. Lorraine Carbon personnel have been showing their motion picture, "How Lorraine Carbons are Made" with a color cartoon and live action showing a carbon arc burning, in slow motion, proper mirror adjustments and carbon alignment for the best possible projection. The film is being shown throughout the country to IA locals, at manager and exhibitor meetings and to Lorraine dealers so they may bring themselves up to date on new developments in carbons. When an appointment was made to show the film to Jerry George, manager of National Theatre supply Co. in Buffalo, it was not known that he would end up in the hospital in traction for a spine injury. He was so interested in the film, however, that the scene above devoloped — Bill Spooner of Lorraine Carbons, an IA member, and George Robinson of Local 121 IATSE, Niagara Falls, N. Y., rigged up a special projection which put the whole Lorraine story on the hospital ceiling. (Left to right above are Messrs. Robinson, Spooner and George.) Edward Lachman of Lorraine Carbons feels this is the first time anyone has seen the Lorraine "attraction in traction."

SMPTE Has New Chapter At Boston U.

NEW YORK, N. Y.—The board of governors of the Society of Motion Pictures and Television Engineers has authorized the establishment of a student chapter of the society at Boston University, it was announced here by Garland C. Misener, sections vice-president. The new chapter brings to five the number of SMPTE student chapters throughout the country. Others are located at City College, of New York, Rochester Institute of Technology, University of Southern California and the University of Miami.

Instrumental in the formation of the new chapter was Alexis E. Ushakoff, Jr. of the faculty of the Boston University School of Public Relations and Communications.He has been assited by Dave Nobling, a student at the university, and members of the Boston section of the society.

AUDIO-VISUAL
EDUCATIONAL • INDUSTRIAL • COMMERCIAL

School Moviemaking Know-How, Knowledge of Film Exposure Ratings Gives Amateur Movies A "Professional Touch"

THE SCHOOL motion-picture projector has found a valuable ally in the 16-mm camera. Field trips, sport events, science projects, amateur dramatics, commencements, and other red-letter days in the life of the school are being increasingly recorded on film by alert educators. An extensive library of school-made movies has unique instructional and morale value.

A 16-mm camera is preferable to the 8-mm "home-movie" type of camera for many reasons. The wider gauge provides better pictorial quality with larger, brighter pictures, and permits "intercutting" with professionally produced releases. If sound is needed, and the regular optical soundtrack seems too much of a luxury, the processed films can be magnetically striped and recorded with commentary, and music. Many modern 16-mm sound projectors are fitted with auxiliary magnetic recording and reproducing units.

FIG. 1—A photovoltaic light meter of the most modern type. This is the G. E. "Guardian" exposure meter, the already high sensitivity of which can be boosted 64 times with a light-multiplier attachment called the "Dynacell."

FIG. 2—A light reading is being taken 230 feet underground in the Howe Caverns, N.Y., with a G.E. exposure meter preparatory to taking the pretty model's picture.

ASA Film Ratings

In addition to good focus for sharp images and a sturdy camera tripod for rocksteady pictures, a high degree of pictorial quality—the "professional touch"—is provided by the *correct exposure* of the film by the cinematographer. Now, there are many kinds of 16-mm camera film on the market—color, black-and-white reversal, and black-and-white negative, — and these exhibit a wide range of exposure requirements.

Both types of 16-mm *reversal film*, color and B&W, have what is called a "restricted latitude." This means that the camera-lens diaphragm, or *f*-number "stops," must be set rather accurately in accordance with (1) the brightness of the principal subject in the scene to be photographed and (2) the "speed," or American Standards Association exposure rating,

of the film being used. The ASA number is, in fact, a designation of the sensitivity of the film to light when it is subsequently given the normal recommended development.

Reversal films are camera films which are directly developed as "positives," and are ready for showing as soon as they have been processed. Prints do not have to be made from them. Reversal films containing valuable subject-matter can be duplicated by printing if desired, but certain small quality-losses are inevitable. As a rule, however, duplicate copies of 16-mm color pictures are made from reversal originals.

To preserve the original quality of black-and-white pictures when a number of copies are needed, use *negative film* in the camera and order the desired number of *positive prints.* B&W prints made from negatives are relatively inexpensive and provide the highest possible picture quality.

Negative film has the advantage of higher speed, better pictorial quality, and much greater latitude in exposure, with less spoiled footage, than is the case with reversal film. Negatives which have been slightly underexposed or overexposed in the camera can be compensated in the printer to provide prints of acceptable quality. But at least one print *must* be made from a negative because the negative images, having all brightness values in reverse, are useless for projection purposes.

Exposure Meter Necessary

But let's not be satisfied with incorrect exposures! Good exposure and light-intensity meters are absolutely necessary to eliminate the guesswork from movie photography. Double-purpose meters which can be used to determine both the *footlamberts* of light reflected from the subject and the *footcandles* of light incident upon the subject from the "source" (the sun, the sky, or photoflood lamps) are very desirable. The Weston Master III with the "Invercone" attachment is one such meter.

Simplified reflected-light meters, such as the General Electric Guardian and the Weston Direct-Reading Meter, supply the reading in *f*-numbers which indicate the required setting of the camera lens stop. It is necessary for the user to know only the ASA exposure rating of his film (Table I) and the shutter speed of his camera. (The shutter speeds of most 16-mm silent and sound cameras, operating at 16 and 24 frames per second, respectively, range between 1/35 and 1/55 second, with 1/50 second a fair average.)

Although the new "automatic-iris" home-movie cameras are very helpful to the rank amateur, and render exposure meters unnecessary, the use of such cameras for more professional or specialized work is not recommended. The automatic iris regulates itself in accordance with the overall luminance of the scene, not in accordance with the subject which comprises the center of interest in the picture. The result is often "burned-out" faces against dark backgrounds and "blacked-out" faces against white backgrounds. Pictures of this sort are about as far removed from the "professional touch" as you can get!

Two Reference Tables

Table I lists the "daylight" and "tungsten" (photoflood) ASA speed ratings of most of the 16-mm camera films available in the U. S. A. These two ratings differ because daylight and photoflood light differ in color, the latter being yellowish. Note that daylight-type color film cannot be used with good results indoors with photofloods unless a bluish corrective filter (Wratten No. 80B) be placed over the camera lens. Likewise, tungsten-type color film used outdoors in daylight requires

TABLE I: ASA EXPOSURE RATINGS OF COMMONLY USED 16-MM FILMS

COLOR REVERSAL	DAYLIGHT RATING	PHOTOFLOOD RATING
Eastman Color Reversal Daylight SO-260	160	75*
Super Anscochrome Daylight	100	40*
Anscochrome Daylight	32	8*
Kodachrome Daylight	10	5*
Eastman Color Reversal Tungsten SO-270	100**	125
Super Anscochrome Tungsten	80**	100
Anscochrome Tungsten	25**	32
Kodachrome Type A (Tungsten)	8**	10

*Use Wratten Filter 80B (bluish) with Daylight film & photofloods.
**Use Wratten Filter 85 (yellowish) with "Tungsten" film outdoors.

BLACK & WHITE REVERSAL	DAYLIGHT RATING	PHOTOFLOOD RATING
Eastman Tri-X Reversal Panchromatic	200	160
DuPont High Speed Rapid Reversal Pan	125	100
Gevapan-32 Ultra Reversal	100	64
DuPont Rapid Reversal Panchromatic	80	64
Eastman Plus-X Reversal Panchromatic	50	40
Ansco Hypan Reversal	40	32
Gevapan-26 Super Reversal	25	16
Gevapan-23 Micro Reversal	12	8

PANCHROMATIC NEGATIVE	DAYLIGHT RATING	PHOTOFLOOD RATING
Ansco Super Hypan	500	400
Eastman Tri-X	320	250
DuPont Superior-4	320	250
Gevapan-33	125	100
Ansco Ultraspeed Panchromatic	100	80
Eastman Plus-X	80	64
DuPont Superior-2	80	64
Gevapan-30	80	50
Ansco Supreme Panchromatic	64	50
Eastman Background-X	40	32
DuPont Panchromatic 914A	40	32
Gevapan-27	32	20

POSITIVE-TYPE FILMS	DAYLIGHT RATING	PHOTOFLOOD RATING
Eastman Variable-Density Recording 7373	....	16
Eastman TV (Kinescope) Recording	....	15?
DuPont TV (Kinescope) Recording	....	15?
DuPont V-D & V-A Sound Recording	....	15
Eastman Variable-Area Recording 7375	....	12
Eastman High-Contrast Positive	....	5
Eastman Fine-Grain Release Positive	....	2
DuPont Fine-Grain Release Positive	....	2

TABLE II: PHOTOFLOOD LIGHT INTENSITIES FOR INDOOR FILMING

TUNGSTEN ASA FILM RATING	FOOTCANDLES OF KEYLIGHT INCIDENT UPON SUBJECT For shutter speed of approximately $^1/_{50}$ sec.					
	f/1.4	f/2.0	f/2.8	f/4.0	f/5.6	f/8.0
2	1250	2500	5000	10000	20000	40000
5	500	1000	2000	4000	8000	16000
8	320	640	1280	2560	5120	10240
10	250	500	1000	2000	4000	8000
12	200	400	800	1600	3200	6400
15	171	341	683	1365	2731	5461
16	160	320	640	1280	2560	5120
20	120	250	500	1000	2000	4000
32	80	160	320	640	1280	2560
40	64	128	256	512	1024	2048
50	50	100	200	400	800	1600
64	40	80	160	320	640	1280
75	34	68	137	273	546	1092
80	32	64	128	256	512	1024
100	25	50	100	200	400	800
125	20	40	80	160	320	640
160	16	32	64	128	256	512
200	13	25	50	100	200	400
250	10	20	40	80	160	320
300	9	17	34	68	137	273
320	8	16	32	64	128	256
400	6	13	26	51	102	205
500	5	10	20	40	80	160

a yellowish filter (Wratten No. 85).

Table II supplies the value of illumination *incident upon the subject* which is needed for correct exposure with photoflood lamps indoors when the lens speed (*f*-number) and ASA rating of the camera film are known. Intelligent use of these data with light meters of good quality will go far to insure the "professional touch" of correct film exposure.

RAGS TO RICHES IS MAG TAPE TALE

SAN FRANCISCO—Telling the magnetic tape recording industry's rags-to-riches story on the eve of the $3½ million 1960 High Fidelity show, in San Francisco, Mr. Herbert L. Brown, president of the Magnetic Recording Industry Assn., said that the stereo disc had "delivered tape a cruel blow" and two years ago tape appeared to be going down for the count.

Ironically, the stereo disc, as it turned out, was the best thing that ever happened to tape, Brown said.

"In early 1949 tape was at the right place at the right time with the right development — music recorded stereophonically on four tracks rather than on two", Brown said. "Immediately this cut tape costs in half. Coupled with other developments this allowed us to place tape in competition with the disc. We did this without losing one of tape's most priceless attributes — fidelity!"

The industry is now enjoying its biggest boom ever in suppying machines and music, the association president explained. In 1960 it is estimated that the industry will manufacture 750,000 machines valued at $170,000,000 as compared to 650,000 machines, valued at $140,000,000, in 1959.

RCA TV TAPE RECORDERS

NEW YORK — Forty advanced RCA television tape recorders have been shipped to broadcasting stations, networks, government agencies and overseas users with 100 more machines on order, T. A. Smith, executive vice president, Industrial Electronic Products, Radio Corporation of America, announced. Demand for the new RCA TV tape recorder is said to have grown by leaps and bounds since its introduction last March, as a vital aid not only to U. S. broadcasters, but to stations in Japan, Australia, England, Canada and other countries.

E. F. Day Named to Bausch & Lomb Post

ROCHESTER, N. Y.—E. F. (Bert) Day, has been appointed manager of the new photographic and industrial optics sales department of Bausch & Lomb. Mr. Day, who has previously been head of the photorgraphic and special prowill now assume ehe added responsibility of the com pany's entire line of motion picture products.

Day

These include the BalCOLD reflector, CinemaScope and Cinephor projection lenses, BALtar professional motion picture camera lenses and specialized lenses and filters. These last include TV Vidicon Camera lenses, both regular and non-browning for nuclear use. His extensive sales experience with photographic products well qualifies him for this new position, the company says.

Creation of the new department will provide a complete integration of sales procedure within the motion picture line which includes the range of products covering the original photography to final theatre projection.

3M Tape Can Take Rough Use

A sturdy new recording tape designed to withstand rough treatment has been announced by Minnesota Mining & Manufacturing Co.

"Scotch" brand No. 311 magnetic tape — featuring a new backing material called Tenzar — is tear-, stretch-, and moisture-resistant, yet is priced in the same range as standard acetate-backed tapes, the company says.

An extra feature of Tenzar-backed tape is that it has a different color on each edge making it especially useful for dual track recording as the two distinct colors clearly identify which track is being used.

A free folder and a strength test sample of "Scotch" brand No. 311 tape is available from the 3M Company, Dept. EO-41, 900 Bush Avenue, St. Paul 6, Minn.

LARGE-AREA FRAMES

(Continued from Page 8)

cept for the somewhat larger negative employed, this process resembles conventional CinemaScope photography on 35-mm film, that is to say, the 2X image squeeze is furnished by an anamorphic attachment on the camera lens. The 35-mm release prints are made by simple optical reduction, and the resulting quality is about Q. Due to the fact that Panavision and Technirama give higher image quality, the CinemaScope-55 process is no longer widely used.

It has been found that the resolution of image detail on CinemaScope release prints is somewhat better if the anamorphosis, or image-squeezing, is provided by a lens in the optical printer rather than on the regular camera lens. For this reason the quality of C'Scope prints made from VistaVision negatives may be slightly higher than indicated in this article. The Technirama process divides the squeezing between the camera and the printer, as we have seen, thereby gaining a small advantage. All of the anamorphosis is accomplished in the printer when C'Scope prints are made from 66-mm negatives; and because the high aspect ratio of these negatives necessitates no image cropping during the transformation, the full quality of the non-anamorphic pictures is preserved. This method, often called "M-G-M 65" and "Panavision," is the process *par excellence* for C'Scope-type prints.

Wide-Gauge Film

As stated in Part I of this article, there is nothing new about 70-mm film, but it is far more important today than it was in the early days of sound. The realistic wide screen is necessary to display the panoramic visual sweep of many modern productions. And in all applications except 35-mm *non-anamorphic* reduction prints, for which VistaVision undeniably excels, wide-gauge film provides the highest picture quality which has yet been attained.

Cameras made for 70-mm filming ordinarily use 65-mm negative stock, the extra 5 mm of width in the print being occupied by stereophonic magnetic soundtracks. The quality of 70-mm contact prints made from 65-mm negatives is 1.35Q, a notably high figure considering that the aspect ratio is 1:2.35, the same as that used for CinemaScope. These prints are shown with an aperture measuring .808" x 1.900" to obtain this aspect ratio on the screen, although other 70-mm apertures having slightly different dimensions are used, as in Todd-AO showings.

The full 70-mm image quality of 1.35Q is preserved in 35-mm CinemaScope prints made by slight reduction of the image and horizontal anamorphosing by a factor of 2X. Neither dimension is cropped and wasted, as in the making of C'Scope prints from VistaVision negatives.

Standard non-anamorphic 35-mm prints may be made by simple reduction, of course; and when the reduced frames are proportioned for the Academy aperture (1:1.375), full quality is retained even though large areas of the picture at the sides are lost by horizontal cropping. However, when such a print is shown at 1:1.65, the quality is 1.13Q, or only 1.01Q when shown at the more common 1:1.85 ratio. But these prints can also be made with increased reduction and wider framelines for the 1:1.65 ratio, as is the practice with VistaVision. The quality is then the full 1.35Q at 1:1.65, or 1.20Q at 1:1.85. The corresponding Technirama quality is very much lower (1.03Q), while that of VistaVision is appreciably higher (1.28Q).

Widefilm Projection Problems

The problems peculiar to wide-screen projection and the relative merits of 35-mm and 70-mm projection prints have been much debated for many years, and are especially pertinent at the present time because of the general availability of such excellent combination 35/70-mm projectors as the Norelco (Philips), the National Seventy (Bauer), and the Victoria-X (Cinemeccanica), the three makes which have met with the enthusiastic approval of projectionists who have had the opportunity to operate on them. All of them have the desired easy-to-operate unit construction of picture mechanism and sound reproducers.

It is obvious that even though the *inherent* image qualities of wide-gauge contact prints and 35-mm reduction prints from 65-mm negatives may be the same (except possibly in the case of certain color prints in which misregistration and dye-bleeding are important factors), more light can be forced through the large 70-mm projector aperture (measuring .808" x 1.900" for Panavision, .866" x 1.913" for Todd-AO) with less film buckling and with less damage to the film.

In point of fact, the 70-mm aperture of 1:2.35 aspect ratio has 3.10 times the area of the conventional 35-mm Academy aperture, 2.56 times that of the CinemaScope aperture, and fully 4.16 times the area of the non-anamorphic 1:1.85 widescreen aperture. This means that the 70-mm projector can safely deliver from 2½ to 4 times more light to the screen than the most efficient 35-mm projector—an important consideration when giant indoor and drive-in screens must compete qualitywise with brilliantly lighted screens of only moderate size.

70-mm For Giant Screens

There is nevertheless considerable doubt anent the advantages of 70-mm film for screens under 30 feet in width. Due to the fact that

image quality—emulsion grain and associated resolution factors—are determined largely by the overall magnification of the *original* negative frame by the projection process, a 35-mm reduction print of a 65-mm negative is inherently very nearly as sharp as a 70-mm contact print of the same negative; and if the maximum aspect ratio of 1:2.35 is required on the screen, an anamorphosed CinemaScope-type 35-mm reduction print preserves the full panoramic expense of the negative image as well as its pictorial quality.

The lens focus needed for 70-mm projection is not very much greater than the E. F. of the prime lens needed to produce the same size of picture at the same throw in 35-mm CinemaScope projection. Assuming identical screen-image heights and a constant aspect ratio of 1:2.35, a 70-mm objective lens of n inches E. F. is exactly matched in 35-mm projection by a CinemaScope prime lens of $1.13n$'' E.F.

Film buckling in the gates of 70-mm projectors is practically twice normal buckling *when the radiant-density flux on the film is the same,* but the use of curved gates and the fact that the density of radiation per square millimeter is usually less than in "high-powered" 35-mm projection nearly eliminates film-buckling effects which are frequently ruinous to the focus in non-anamorphic 35-mm presentations.

All factors considered, it may be said that 70-mm projection is somewhat superior to 35-mm projection, but this superiority is evident only when the screen is wider than about 30 feet. Wider screens practically demand a projection print wider than the standard 35 millimeters. Also, the use of six magnetic tracks of high quality on 70-mm prints for the most realistic stereophonic sound is a feature to be thoughtfully considered by the owners of the largest indoor theatres.

A 35/70-mm projection installation replete with Norelco, Victoria-X, or National-70 projectors, high-powered Ashcraft, Strong, or National arc lamps, 6 track magnetic sound for 70-mm presentations, 3-track magnetic sound for some CinemaScope prints, optical sound for all other 35-mm films, four or five sets of aperture plates and lenses, and an array of complex amplifiers, switchover systems, emergency channels, and safety and film-cooling devices including both air-blowers and water-circulators for lamps and projector mechanisms, etc. etc. certainly contrasts strikingly with a 1906 silent-picture projector set up in a boxlike "booth"! The complexity and responsibility of the projectionist's profession have increased over the years.

It may be argued that modern projection-and-sound layouts have become too complicated to be operated efficiently by mortal projectionists having only two arms! But screens are larger, picture and sound requirements are tremendously more exacting and the complexities of a modern, completely equipped projection room are absolutely necessary for the flexibility of operation demanded by two film sizes and a multiplicity of sound-reproduction and wide-screen methods.

Simplification, when it comes, will result from the omission of all nonessential items and from *standardization,* the use of only *one* size film and presentation method for *each* type of theatre. Whether wide film gauges offer sufficiently substantial advantages to outweigh their cost and completely displace the long-established 35-mm gauge at some future time is indeed an intriguing question.

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EXCLUSIVE! J.G.JACKSON REVIEWS THE PRINCIPLES OF NON-INTERMITTENT PROJECTORS

INTERNATIONAL

PROJECTIONIST

Including a special Audio-Visual section relating to the operation and maintenance of A-V equipment in the educational and industrial fields.

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EAST COAST OFFICE
545 Fifth Avenue
New York 17, N.Y.
Murray Hill 7-7746

RAY GALLO
General Manager

MIDWEST OFFICE
4616 Washburn Avenue South
Minneapolis 10 Minnesota

FRANK W. COOLEY, JR.
Editor and Publisher

R. ENTRACHT
Associate Publisher

RAY GALLO
General Manager

R. A. MITCHELL
Technical Editor

In This Issue . . .

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MONTHLY CHAT

Hi-Fi Not to Public's Taste?

THE THEATRE PROJECTIONIST who knows what a "live" orchestra sounds like, and is a stickler for *natural* sound reproduction, usually finds himself the victim of frustrating circumstance. His sound equipment may be antiquated and utterly incapable of anything even approaching high-fidelity reproduction. In such a case he is licked from the start. But if his hard luck soundwise tempts him to contemplate suicide, he would do better to contemplate the pitiful plight of his brother projectionist in the plush downtown theatre. The big-theatre projectionist may preside over the finest wide-range stereophonic sound system without once daring to utilize its full capabilities!

The cause of this sad state of affairs is a general ignorance among the moviegoing public of the acoustic facts of life. How many of the patrons in *your* theatre have recently attended a Broadway musical, an opera, a pipe-organ recital, or a symphony having the full complement of eighty-some instruments? Not many, if the popular concept of what music *should sound like* is any criterion!

Dynamic Range Distorted

While diffusing music to an astonishing degree, and bringing the finest compositions and performances to the millions, the phonograph and radio have nevertheless distorted the dynamic range of musical instruments and orchestras by compression, limited the frequency range by clipping, and totally destroyed acoustic perspective — and this in spite of that most recent audio innovation, the binaural gramophone record.

He is indeed a true lover of *natural* musical rendition who utilizes the full flat frequency spectrum of his hi-fi phonograph. Few do. Most are addicted to treble-attenuation and bass-boost, a musical narcotic which emulates the bland, muffled boom-boom of that monstrous destroyer of tonal beauty, the jukebox. One "authority" on the subject recently declared (after having heard a live orchestra, possibly for the first time in his life) that electronic distortions of music were better than the real thing!

Music Should Sound the Same

Mere loudness does not constitute high-fidelity sound, of course. But it is discouranging to hear certain movie partons complain that "the sound is too loud" when the title music and background accompaniment in a film runs to twice the volume of normal dialogue. *The "canned" music on the soundtrack should sound the same as "live" music in regard to both volume and frequency range.*

Worse, complaints of excessive loudness have even been muttered *sotto voce* by patrons at Todd-AO and Panavision showings. If *any* system of sound reproduction can emulate natural sound to perfection, with full dynamic range and with acoustic perspective, it is surely the 6-channel stereophonic system used with 70-mm film! The performances heard by the

Continued on Page 22

INTERNATIONAL PROJECTIONIST

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Non-Intermittent Projector Operating Principles Detailed; New Development Introduced

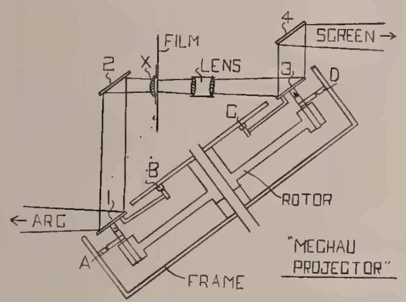
By J. G. Jackson

The Mechau projector utilizing continuous film movement and moving mirrors instead of the orthodox intermittent sprocket and shutter needs no introduction to readers of IP. Neither does J. G. Jackson, the noted cinema technologist of British Columbia.

By way of introducing a detailed description of his own ingeniously simplified non-intermittent projector, Mr. Jackson herewith explains the operating principles of the Mechau. Years of dependable Machau operation in theatres and TV studios overseas should go far toward inspiring the active interest that the Jackson mechanism certainly deserves.

—TECHNICAL EDITOR, IP

THE MECHAU PROJECTOR, sometimes referred to as the Arcadia , was invented in Germany by Emil Mechau and was patented in the year 1919. This projector was not generally accepted by the industry in any country, although there are a few still in use to this



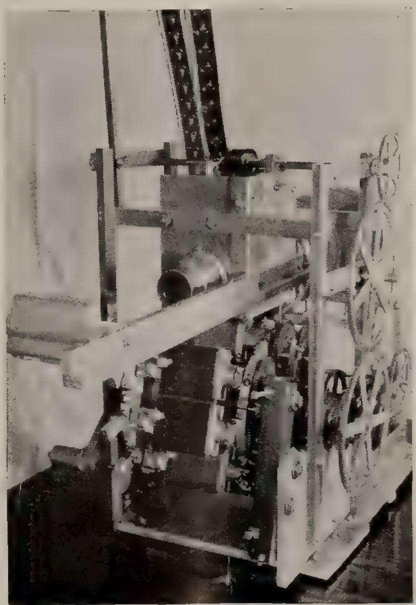
day. By all reports they still give a satisfactory screen image. (See I.P. for December 1959,p. 12.)

The drawing shows a cross section of the projector so as to explain the working principles. A series of plain first-surface mirrors are mounted on a rotor which is supported in a frame set at 45 degrees. Incidentally the original projector lay perfectly flat, as shown by the Mechau patent.

The mirrors, presumably 8 in number, are mounted on what the inventor calls a Cardan joint — one on which the mirrors may twist and tilt at the same time. The mirrors must twist to compensate for the rotation of the mirror unit. Circular cams shown as A and D on the rim of the drum frame, guide-rocker arms give the mirrors a slight twist as the unit revolves. Cams B and C, sup-

lens X. From there the light passes ported by the top section of the frame, control another set of rocker arms to tilt the mirrors as they revolve. This tilting compensates for the downward movement of the film past the aperture. Thus the mirrors twist and tilt at the same time as they pass through the light beams.

Tracing the light beam from arc to screen: First the light from the arc falls onto mirror 1 and is reflected upward to a fixed mirror 2 which, in turn, reflects it to the



HOMEMADE MODEL of Jackson non-intermittent projector now on display in Los Angeles County Museum. Mirrors tilted by only one cam to control image on screen. Mirrors not exposed to direct heat of arc.

are exposed to the direct heat of through the aperture, film, and the projection lens, then onto mirror 3 which reflects it up to another fixed mirror, 4, and from there to the screen.

The purpose of lens X, as explained by the inventor, is as follows: In conjunction with the projection lens, it forms an image of mirror 1 directly onto the face of mirror 3. Thus the mirrors on opposite sides of the rotor work in pairs to control the light. The mirrors, while passing through the arc beam, such as mirror 1, cause the spot to follow the frame on the film as it moves downward past the aperture. Mirrors at the top, such as mirror 3, also follow the film-frame to produce a steady and continuous image on the screen with successive frames dissolving into each other.

Thus it can be noted that it requires *four* accurately ground cams to give precision control of the mirrors.

As the mirrors must pass through the light beam between the light source and the aperture, they

the arc. Even with filters the heat from modern high-amperage arcs is bound to be quite high. Such heat could cause warpage or even breakage of mirrors.

Modern high-amperage arcs with large-diameter mirrors give a cone of light with a considerable taper. It then follows that additional optical components would be required to use them on this projector, since the mirrors in the position of number 1 are at a considerable distance from the aperture, at which point the light beam is quite wide — too wide for the size of the mirrors. Mirrors must be set at 45 degrees.

Could the three above-mentioned features be part of the reason why the Mechau projectors have not been accepted by the industry on a wider scale? The writer, who holds this view, has devoted much time and thought to the subject and has designed a simplified version of a non-intermittent mirror projector, details of which follow herewith.

Jackson Projector Principles

In the design of this projector the inventor has maintained simplicity of design and has obtained a very high degree of efficiency. Since there are no optical elements placed between the light source and the film, there is no light loss there and no heat problem on optical components. As the aperture is single-frame there is no loss by enlarging the spot. All optical components are placed out in front of the projection lens at a point where the light from each frame is separate and distinct so as to be controllable without loss of light.

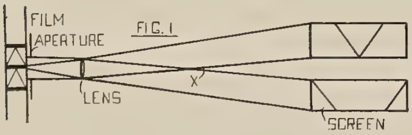
The drawing Fig. 1 shows how this is possible. Here we have a setup with film, aperture, lens, and a screen on which is the image of two partial frames in the aperture. The image of the frame-line is formed in the center of the screen. Here it can be seen that the two beams of light become sepapated at a point marked X a short distance from the lens. In standard projection this point is 20 to 24 inches from the lens. The problem now is to re-arrange these two partial images to form one complete image. This is done at Fig. IA where a controlling element, not shown, is directing each beam to its proper place on the screen so as to form one complete screen image. In this projector the elements *are plain first surface mirrors,* which have very little reflection loss.

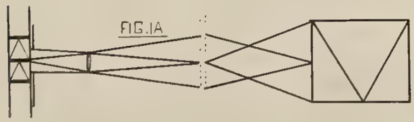
The Optical Principal

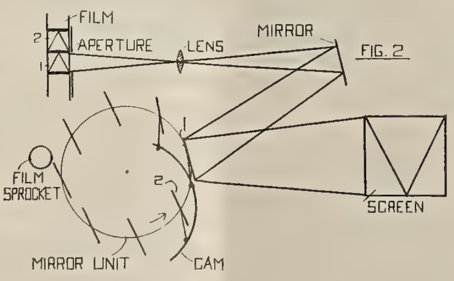
Fig. 2 shows the complete optical principle of the Jackson projector. Here there is one full frame and one frame-line in the aperture. The light from the lens falls onto a fixed plain surface mirror which reflects it back onto a series of plain surface mirrors which are movable. In this case one movable mirror reflects the entire beam to the screen to form the image. The series of movable mirrors are each mounted solidly on shafts which, in turn, are mounted in bearings near the rim of two end plates or carriers. This whole assembly forms a compact unit which revolves counter-clockwise and is geared to the film-drive shaft. It is quite feasable to have the film - drive sprocket mounted on the same shaft as the unit but, for this discussion it will be considered as separate. On the end of the mirror shafts there are rocker arms and pins with rollers which engage with a stationary curved cam that controls the tilt of the mirrors as the unit revolves. The tilt of the mirrors compensate for the movement of the film in the aperture and thereby maintains a steady image on the screen. Note, only one cam is required to control the mirrors.

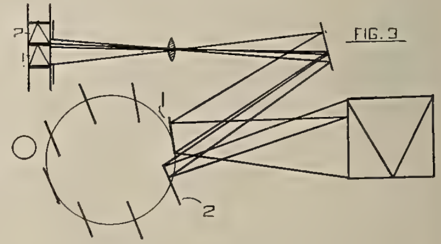
In Fig. 3 the film has moved downward so that frame 1 is beginning to move out of the aperture, while frame 2 is just starting to move in. The screen image is now composed of two distinct light beams from the two partial frames in the aperture. It can be observed that the light from the partial frame 1 is being reflected to the lower area of the screen by the moving mirror 1 while the light from the partial frame 2 is being reflected to the upper section of the screen by moving mirror 2. The screen image is still full and complete, *and there is no loss of light.* The out-of-focus image of the frame- line occupies the area between the two moving mirrors and therefore has no effect on the screen. As the moving mirrors move upward by the rotation of the unit, the image of the frame-line also moves upward by reason of the film movement in the aperture.

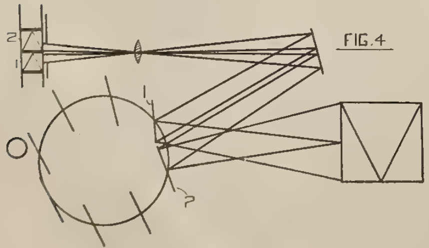
The upper and lower edges of

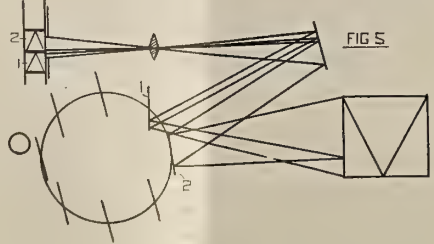


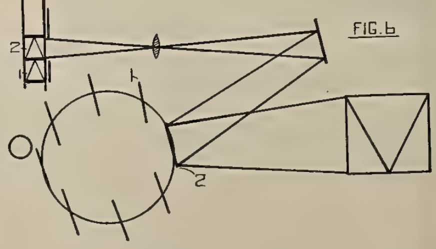












the aperture form the junction line of the two partial images on the screen. As the film moves downward in the aperture, the junction line, which is invisible, also moves downward at a corresponding rate of speed.

In Fig. 4 the film has moved down so that there are now exactly two half-frames in the aperture. Now the two mirrors 1 and 2 are each half filled with light. The screen image is still full and complete, and the junction line is now in the exact center of the screen.

In Fig. 5 frame 1 is almost out of the aperture, while frame 2 is nearly all the way in. Mirror 1 is now reflecting only a small portion of the light and it falls on the lower section of the screen while mirror 2 is reflecting the larger portion of light which fills the full upper section of the screen. The junction line is now near the bottom of the screen, and the image is still full and complete with no loss of light.

Fig. 6 is the same as Fig. 2 except that frame 2 is now completely in the aperture and the frame - line is at the bottom. The entire light beam is being reflected by mirror 2, and as the frame-line leaves the aperture, the cycle of projection is completed.

Thus it can be seen that the light on the screen is continuous and the image is full and complete at all times irrespective of the position occupied by the film-frames in the aperture. The result is continuous projection with a high efficiency rating, as the aperture is single-frame, the only loss of light being in the standard lens plus that of the first surface mirrors, which is practically nil.

The photo is of the home-made working model which the inventor built by hand in his home workshop. This model is now the permanent property of the County Museum in Los Angeles, California.

New Eastman Film

HOLLYWOOD — A new reversal print film developed by Eastman Kodak makes feasible commercial-quality color projection prints from the new, faster motion picture films released several months ago.

A compatible developing process is said to provide the producer with advantages in time, through possible processing at point of use; speed, and excellent qualities of color and definition. The reversal print film is available in 16mm, 35mm and 70mm widths—the latter on special order.

Indiana Local 466 Settles After Halt

FORT WAYNE, IND. — A 5-year contract has been arranged affecting Local 466 after a 2-week strike here. Five theatres were involved, owned by Alliance Theatres Corp. of Chicago and the local Quimby Theatres.

The union sought to renew the old contract which called for two projectionists in first-run houses with a single operator for second runs and drive-ins. Also involved was a disagreement over overtime.

Ballantyne Adds Speaker Guards

OMAHA, NEB. — The Ballantyne Co., manufacturers of theater equipment, in announcing its 1960 line of drive-in speakers, points out that all 1960 Ballantyne speakers will have perforated aluminum speaker guards as standard equipment.

Prior to this year, speaker guards were optional at extra cost. The company said increased production efficiencies allowed the change.

R. S. Ballantyne, company president, said the company would continue to produce six different speakers including both single as well as patented Dub'l-Cone models. He said the company would continue to emphasize speaker protection as well as sound quality.

As in previous years, Ballantyne speakers will have cast aluminum speaker cases to assure more protection, longer life and requiring less maintenance.

Further information and prices are available from Ballantyne at 1712 Jackson St., Omaha 2.

Photographic Slide-Making

The new Polaroid projection film, as well as conventional methods, make the production of slides easy and rewarding.

HOMEMADE SLIDES have an indispensable value in the audiovisual program of any school at all grade-levels. Moreover, the pictorial quality of teacher-made and student-made slides can equal that of the best commercial slides, providing a good camera is used and the negative properly exposed.

Color Slides Desirable

Slides in full natural color, desirable for many teaching purposes, are only partly "homemade," inasmuch as the processing of such color camera films as Kodachrome and Anscochrome, and the printing of color duplicates, is a highly technical procedure requiring special knowledge and skill. Only advanced amateur photographers should attempt to tackle the tricky chore of color processing.

Kodachrome is a "reversal" camera film, ready to be mounted between 2 in. by 2 in. or 3¼ by 4 in. cover glasses or in cardboard slide mounts after it comes back from the processing station. Duplicates of fair color quality can be printed from Kodachrome originals.

Black-and-white negatives are easily developed and printed on emulsion-coated glass or on acetate or Cronar positive film. These may be "toned" to a colored image, if desired (sepia, blue, green, red, purple, etc.), or colored by hand with transparent dyes. The positive transparencies should be thoroughly dry before mounting and projection, otherwise the emulsion may wrinkle, or "reticulate."

Polaroid Method Convenient

The new Polaroid "picture-in-a-minute" transparency film, originally produced for use in TV studios, provides the most convenient method of making single slides. Although the cost of this method is rather high, its simplicity and rapidity are often desirable, even necessary. Development and printing of the film take place automatically in the Polaroid Land camera; and the finished transparency is ready for viewing in a minute or so from the time the picture is snapped. Unfortunately, only black-and-white slides can be made by the Polaroid process. Conventional cameras and Eastman or Ansco color film must be used for slides in true natural color.

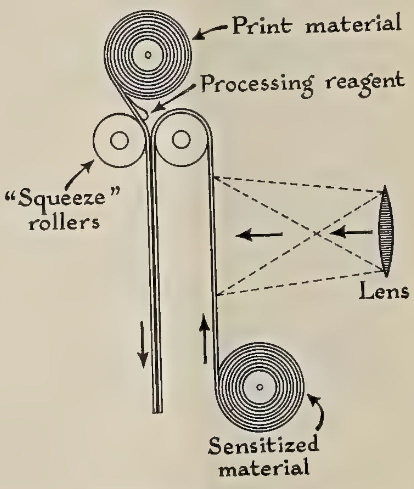
Polaroid film is extremely

"fast," photographically speaking; and the prints are virtually grainless. "Teachers and students can make picture records of important items . . . and have those same pictures ready for projection and study by everyone in the entire class upon return to the classroom. Teachers may copy a map from the morning paper and show it in a current-events class minutes later. A physics teacher may us this transparency system to show enlarged close-up pictures of equipment set up for that day's experiment."*

How Polaroid Works

The Polaroid Land camera with its double negative-and- print material carrying its own developing chemicals is one of the most ingenious photographic systems ever devised.

As the diagram shows, the "sensitized material" (negative film) and "print material" (paper or transparent film for the positive



print) remain separate from each other during actual photography. But as soon as a picture is taken, the negative and print material are moved down together in close contact in the back compartment of the camera. These materials move through rollers which puncture a "pod" of viscous processing solution, one pod for each exposure, and spread it evenly between the two films.

Several interesting things happen in the short space of a minute. The negative is developed to a silver image, and the undeveloped silver halide is transferred to the print material where it, in turn, is developed to a silver image without the aid of light. A non-selective developing agent is present in the print material. It is the transferred and subsequently developed silver halide which forms the positive image. No fixing is necessary because there is no undeveloped halide in the clear areas of the print.

To make a Polaroid transparency, (1) snap the picture with a Polaroid Land camera, (2) pull the paper backing out and off from the film, (3) wait one minute and then remove the finished positive transparency, (4) immerse the transparency into a hardening solution, and (5) dry and mount.

Advantages of Regular Film

Polaroid transparencies may be projected immediately if mounted in Polaroid white plastic holders, but they should be dried for several hours before being mounted between glass. Ordinary negatives printed upon sensitized positive film material may be developed, dried, and mounted between glass in about the same length of time; but, of course, the complete "conventional" photographic process of developing and fixing the negative, washing and drying it, printing the positive and processing and drying that is more time-consuming, and certainly more troublesome, than the convenient Polaroid process.

Conventional photography and film-processing is nevertheless to be preferred when the utmost control over the finished picture is desired, or when a high-quality negative is needed for the production of several identical slides for lending or for insurance against loss or damage. The conventional process also has the advantage of economy and the opportunity it affords to technically-minded students for practice in the creative art of photo-finishing.

Equipment Directory

The Audio-Visual Equipment Directory, Sixth Edition has been published by the National Audio-Visual Assn.

Copies of "The Audio-Visual Equipment Directory" are available at $4.75 per copy ($4.25 if payment accompanies order) from National Audio-Visual Assn., Fairfax, Va.

*A-V INSTRUCTION MATERIALS and METHODS by Brown, Lewis, and Harcleroad (McGraw-Hill, 1959), pp. 456-7.

Labor Relations Unit Jurisdiction Seen in Ruling

WASHINGTON—The results of the controversy between a projectionist of Local 244, the local, and the Stanley Warner theatres of New Jersey indicates that the National Labor Relations Board has jurisdiction over activities of the locals in some circumstances under the Taft-Hartley law.

The NLRB decision was handed down following a complaint by Joseph Weiner, projectionist for Stanley Warner in Essex County, that he had been unjustly suspended from Local 244. The order required the local to reimburse all employes who had been deprived of health and welfare fund benefits because they were not "members in good standing" of the union. The action is seen as a restriction on the locals in their relations with the membership.

The NLRB turned down the local's claim that its activities did not affect interstate commerce and were therefore not subject to board jurisdiction. The ruling indicates that the board now has control over the local segment of a national theatre chain if the annual volume of the chain in the area exceeds $500,000.

Strong Electric Develops New Lamp, Commorates Firms Third of a Century

TOLEDO, OHIO — The development of a new Strong projection lamp has been tied in with the observance of a "Third of a Century of Progress" in arc lamp development started by Harry H. Strong, and plates commemorating the event will be affixed to all these new arcs.

Mr. Strong is founder of the firm, which announced the 1960 Model U-H-I projection lamp, designed to be quickly adaptable to efficient production of either 35mm or 70mm film widths.

The totally new Airscope ventilating system, effectively using 70% more air for cooling, is claimed to be more efficient than that of any previous projection lamp.

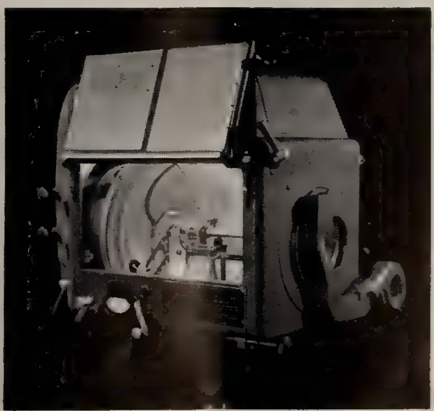
A complete change of air is effected every five seconds. Although having a capacity of 165 amperes, the lamphouse, back door assembly and operator side door maintains a 30 degree lower operating temperature.

A constant curtain of cool air flows over both faces of the cold type reflector to result in a uniform temperature over the entire mirror, greatly reducing thermal stresses that could cause reflector failure. One hundred per cent more air is swept over the reflector in the 1960 U-H-I than in other lamps, it is pointed out.

The maintenance cost of the 1960 U-H-I promises to be much lower than that of any previous high powered projection lamp, Strong claims.

All parts, heretofore considered to be expendable, have been so improved in design and quality of construction that Strong is guaranteeing to replace without cost any non-abused parts (with the

Continued on Page 22



THE NEW STRONG U-H-I projection system is shown in the illustrations above; at the right the lamphouse is open.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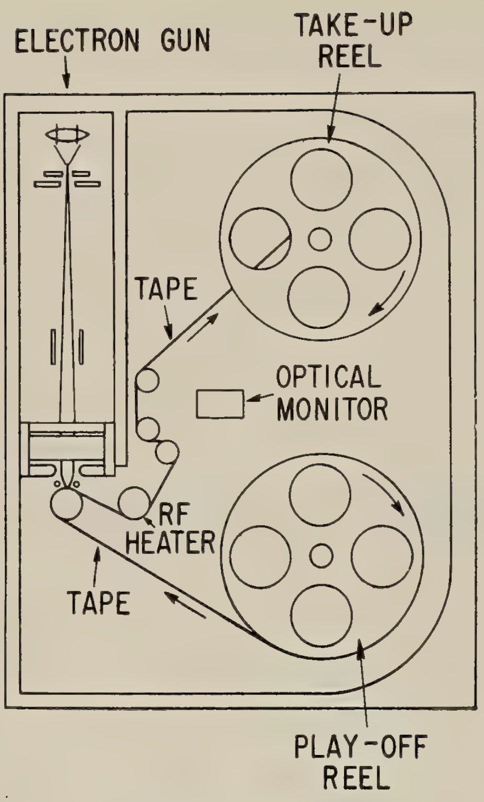


Schematic of TPR recorder.

GENERAL ELECTRIC'S

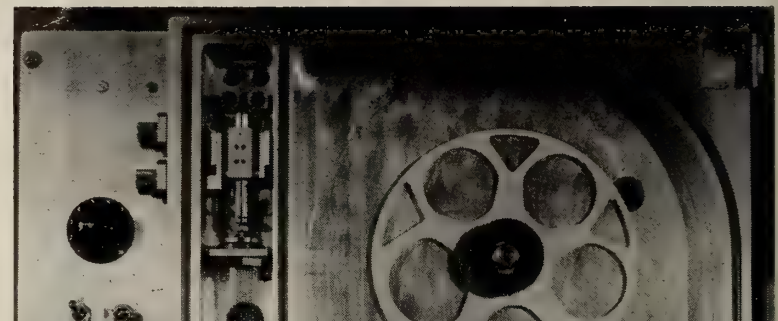
Thermoplastic Recorder

A new recording system, called thermoplastic recording, or TPR, has been developed by General Electric scientists. It is said to combine the immediate playback feature and the versatility of video tape with the storage capacity of photography. And is also said to offer advantages over both of these recording systems. It has a very high resolution, does not require any chemical processing, is erasable, and can be reused. Color images are possible with this system almost as easily as black-and-white images. To view the information recorded requires a very simple modification of standard equipment.

Electrons are used to convert information, including visual images, into microscopic wrinkles in a plastic material. In the recording or "writing" phase, an extremely fine electron beam, modulated by the information to be stored, "writes" upon plastic tape. This "writing" consists of a pattern of charges that the electron beam lays down upon the plastic surface.

After the charges have been deposited, the plastic is temporarily softened by heat. This enables electrostatic forces created by the charges to deform or wrinkle the molten plastic surface. The plastic is immediately allowed to harden. This freezes the information-bearing wrinkles on the surface, forming the record. This entire process is completed in less than 1/100th of a second.

Reproduction or "reading" of the transparent thermoplastic record is effected by an optical system which makes use of the phenomenon of "diffraction." The pattern of wrinkles recorded on the film diffracts, or



THERMOPLASTIC RECORDER—The thermoplastic tape moves from the play-off reel (bottom), past an electron gun, a heating unit, and an optical monitor to the take-up reel (top).

Reprinted from the March, 1960 Issue of INTERNATIONAL PHOTOGRAPHER

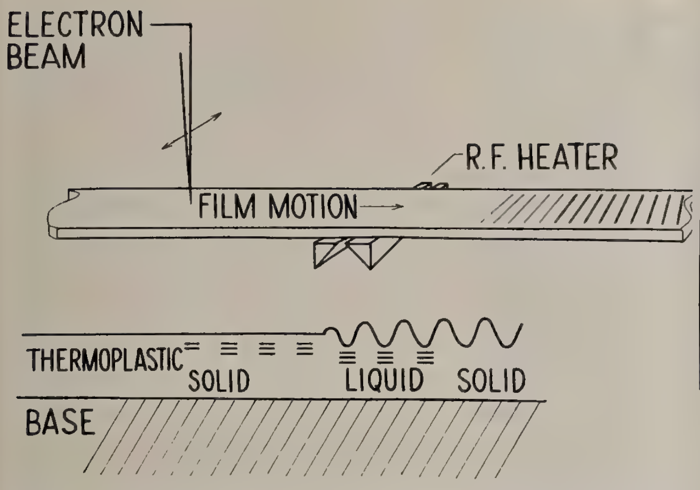


Figure 1. Mechanism for thermoplastic recording, and cross-section of TPR tape.

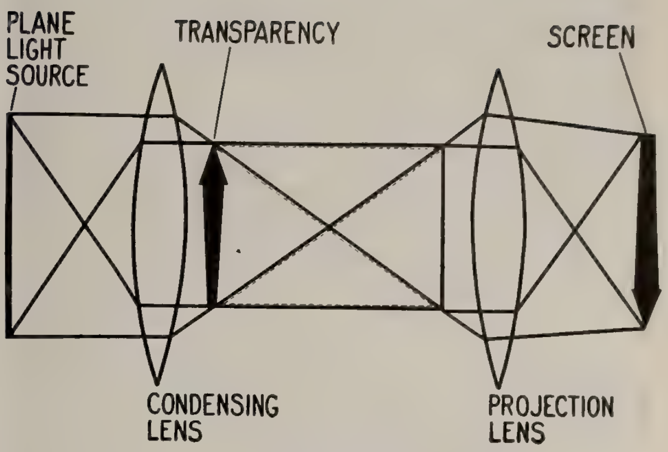


Figure 2. Conventional projection system.

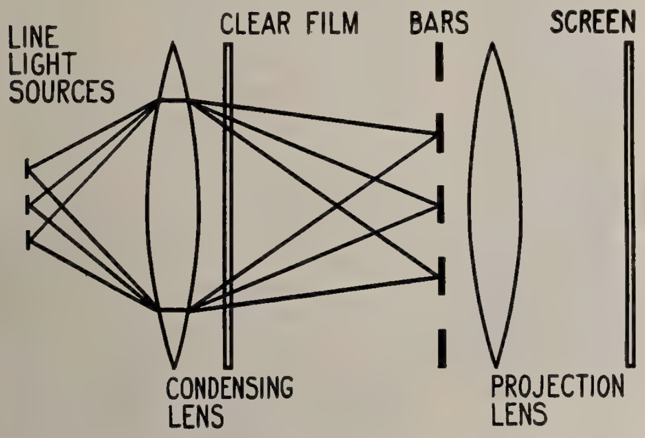


Figure 3. Projection system suitable for TPR (with no ripples on film; ripples would permit light to pass between bars, creating an image on the screen).

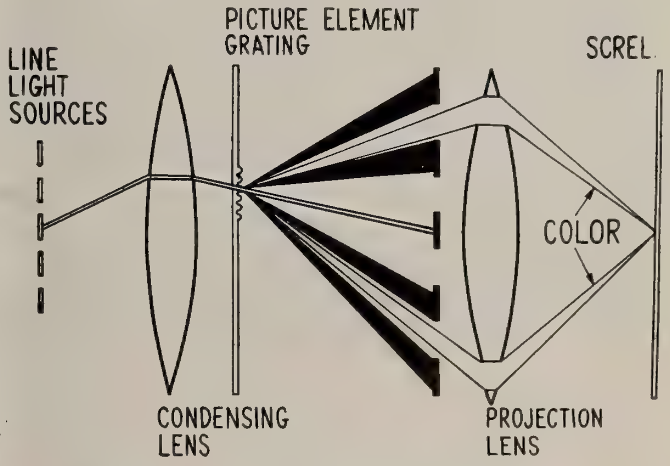


Figure 4. Color projection using TPR system.

scatters, light in a systematic way to reproduce information. This can be done on a screen, as with motion pictures, or on a photoelectric device to generate an electrical signal. For color reproduction, a special optical system projects an image in full color from the wrinkled surface of the thermoplastic record.

Thermoplastic recording can already concentrate 100 times as much information in a given space as can magnetic recording, and it has the potential for still greater concentration. As an illustration of its extreme storage capacity and speed, TPR could in principle record all 24 volumes of the Encyclopedia Britannica on a reel the size of a spool of thread, taking only a minute to record each volume.

Figure 1 shows the recording process and one type of thermoplastic film. The film has a base. that is similar to the standard moving picture film base. On top of this is a transparent conducting coating, and on top of the transparent coating there is a thin coating of thermoplastic material. This material will melt if it is raised to a fairly high temperature.

The surface of the thermoplastic is charged with an elctron beam in a pattern that corresponds to the pattern of ripples that is to form the image. As the film moves on, a current is induced in the transparent conducting coating, which heats the film so that the thermoplastic coating melts. The charges are attracted to the transparent conducting coating and depress the surface of the thermoplastic. After the surface has been deformed by the charges, the film is then allowed to cool, thus freezing the ripple pattern in place.

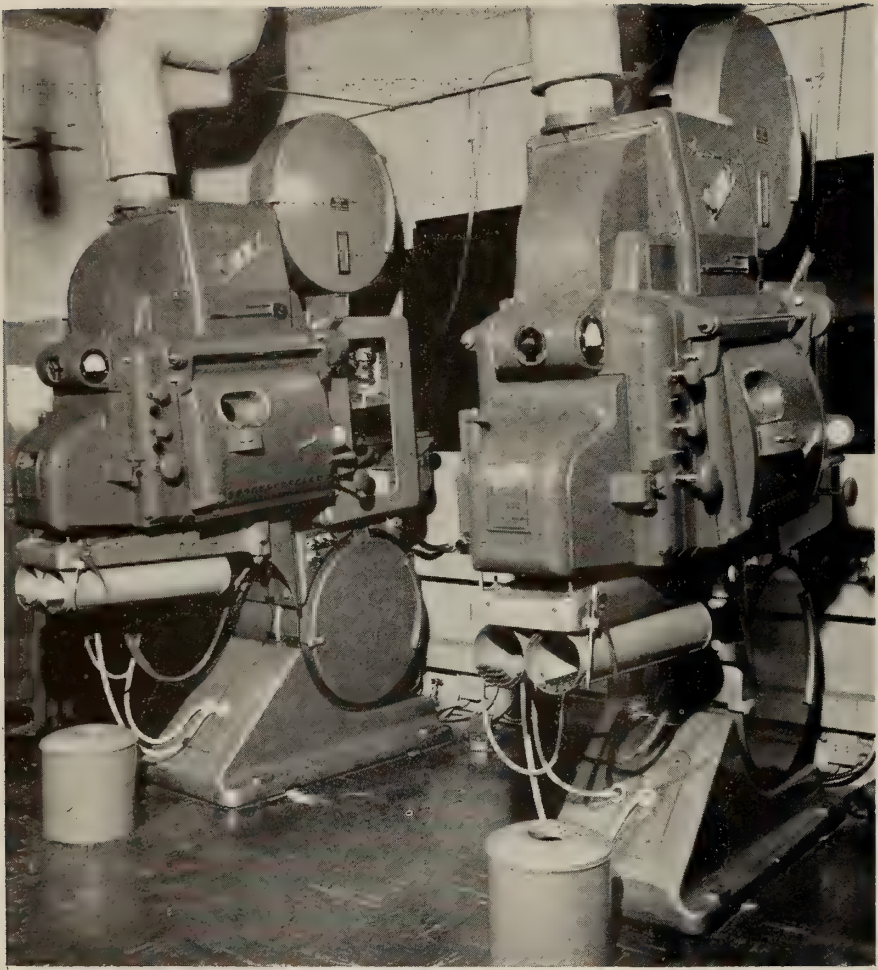
To erase the information, simply heat the thermoplastic again to a higher temperature, so that the charges leak away and surface tension smooths the surface back out to its original state. The film is then reusable.

The film, of course, must be handled in a vacuum, since the electron gun has to work in a vacuum. This is not nearly as much of a problem these days as one might think. It only takes about one minute to pump the machine down from atmospheric pressure to a vacuum low enough for effective operation.

The signal input, in this particular recorder, is simply the intermediate-frequency signal out of a black-and-white TV set, at about a one-volt level. If the images are to be recorded in color, another signal has to be added to another electrode, also at about a one-volt level.

Figure 2 shows how a standard projector works. It has a plane light source, a condensing lens, and a projection lens. The light source is imaged on the projection lens by means of a condensing lens, and the projection lens images the slide to be projected on the screen.

If we now modify this (Fig. 3) so that instead of using a plane light source we use line light



THE ILLUSTRATION above shows a recent installation of an Ashcraft "Super-Cinex" arc lamp at the Fox Sheridan Theatre in Miami Beach, Florida. The "Super-Cinex is shown with a 35/70 Norelco Projector.

sources, and image these on a set of bars in front of the projection lens, no light will get through to the screen. If, however, we have *ripples* on the surface of the film at any particular point, these will scatter light through the bar system. Thus, the bar system acts somewhat like a shutter that allows light to pass wherever there is a ripple on the film. Whenever light passes through the projection lens, it images the ripple on the screen as a white spot. A clear slide that simply has ripples on the surface, if projected, will appear as a black-and-white picture on the screen.

This system can be modified so that it can be used to produce color pictures. Figure 4 shows how. Each picture element has in it a set of ripples that form a little diffraction grating. The light that is diffracted by this grating forms a spectrum on each side of the central beam. The slots are made small enough so that only one color from the spectrum gets through to the projection lens. Since the projection lens can receive only one color of the spectrum, the spot that appears on the screen will appear in a single color. To make the spot appear in another color, the spacing of the grating is changed so that a different part of the spectrum gets through the slot. In order to produce a color that is formed by a superposition of two or more colors, superimpose the gratings in this spot and the result will be the color desired.

The film used at the present stage of development is the size of standard 16 millimeter film. Larger-size recordings use half the width of the film—the images are actually 5 millimeters wide—and the film runs a 10 inches a second. It is also possible to record with full resolution at half this picture size, so that the width of the track on the film is a tenth of an inch wide, with the film running 5 in. sec.

As noted, however, the recorder runs at only 5 inches a second rather than at the $7\frac{1}{2}$ inches a second used in audio recording tape. This is true despite the fact that video recording requires approximately 100 to 150 times the density of information that is ordinarily required by audio. As a result the recorder is doing more than 100 times the work of an audio tape recorder.

Like photography, TPR possesses the advantage of almost instantaneous recording, but it does not require the chemical processing needed by photographic film. It can also record both in color and black and white, and it can be reused.

One of the earliest signifiicant recording systems involved hieroglyphs. The survival of carved stone tablets from pre-biblical times is testimony to the *permanency* of such records, but the compactness and *portability* of this stored information was not exceptional. The basic method employed in this ancient device was mechanical—indentations carved in stone. TPR may be regarded as the ultimate refinement of the stone tablet. The stone is replaced by a thin transparent film, and the carving tool is an electron beam. Because this tool is extremely sharp, it will carve microscopic indentations, which are then read off by optical-electronic means. In the history of man's effort to preserve his art and his science, thermoplastic recording is a significant contribution.

EACH FRAME of the thermoplastic record, above, is less than a quarter of an inch wide and fits easily inside a paper clip. The image is recorded in the form of microscopic indentations, but when ordinary light strikes the record at an angle, the image can be seen with the naked eye.

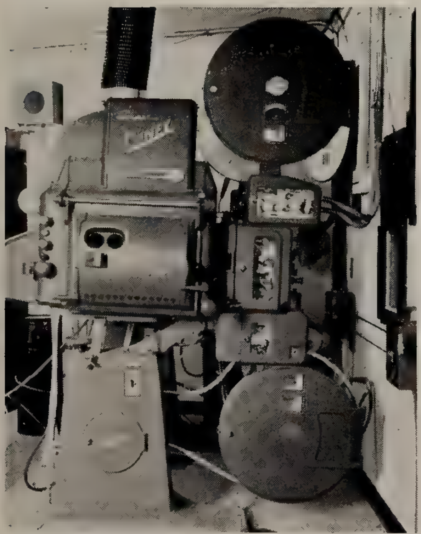
KODAK SALES DOUBLE SINCE '50

ROCHESTER, N. Y. — Eastman Kodak's sales have about doubled since 1950, according to the company's annual report. A 10-year statistical table shows that total sales of Kodak's United States establishments increased from $457.8 million in 1950 to $914.1 million last year.

Net earnings also doubled, with a gain from $61.9 million to $124.7 million. Earnings before taxes rose from $122.4 million to $257.2 million, the report shows.

As disclosed last month 1959 sales of Kodak's U. S. units advanced 10% over the previous year and net earnings were up 26%. Sales in early 1960 showed moderate advance over the early weeks of 1959.

Photographic products continued to account for more than two-thirds of the company's sales again last year with chemicals for photography, industry and research accounting for 9% and professional motion picture film 8%.



ANOTHER CENTURY 70-35mm projector installation is shown above in the beautiful new hard-top Hellman Theatre, Albany, N.Y. One of the features of the Century system is the newly developed Century Magnetic Reproducer.

Dichroic Mirrors . . .

. . . their principles, anatomy and care

BY ROBERT A. MITCHELL
Technical Editor

THE INTRIGUING optical phenomenon of *interference* is largely responsible for successful projection on large drive-in and indoor screens. Without interference-type ("dichroic") heat filters and arc-lamp mirrors, motion-picture film could not withstand the terrific blaze of radiation needed to illuminate large screens.

It is the consensus of opinion that 75 amperes is the greatest amount of current that should ever be burned in a high-intensity arc lamp for 35-mm projection without heat filters when a silver-coated mirror is used in the lamp to reflect and focus the "spot" of light on the film aperture. As a matter of fact, severe buckling of the film and blistering of the emulsion have been known to occur at currents as low as 70 amps. under these conditions, although it

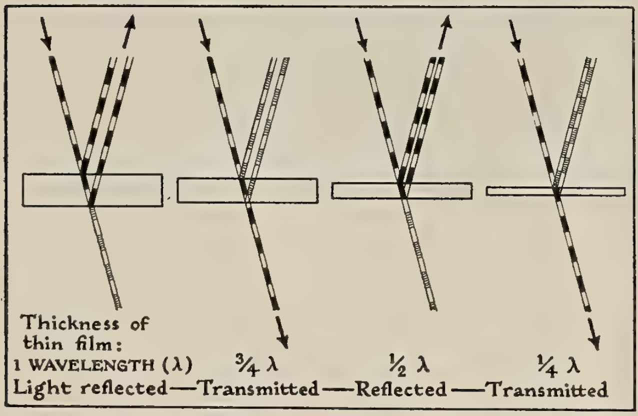


FIG. 1—"Interference" of light. When a ray of light shines upon a thin transparest film equal in thickness to 1 or ½ the wavelength of the light, "reinforcement" of the waves occures, and the ray is totally reflected. If the film is ¾ or ¼ wavelength in thickness, "cancellation" of the reflected waves results in total transmission.

is also true that higher arc currents have been used without too much ill effect when the lamps were not in a condition of optimum optical adjustment.

The HI-arc radiation reflected by a silver-coated mirror comprises a broad band of wavelengths, only part of which is perceived by the human eye as visible light. Among the invisible radiations are a small amount of ultraviolet, which is chemically active and dangerous to the eyes even though it cannot be seen, and a large amount of heat-producing infrared. All of these radiations, including the visible wavelengths from violet through blue, green, yellow, and orange to red, generate heat whenever they are absorbed by film or any other material substance.

The ultraviolet component of HI-arc radiation is not generally regarded as a serious heat problem; but it is undeniably present, and it is useless to the projection process because it does not contribute to the brightness of the picture. The presence and chemical energy of the ultraviolet is easily demonstrated:

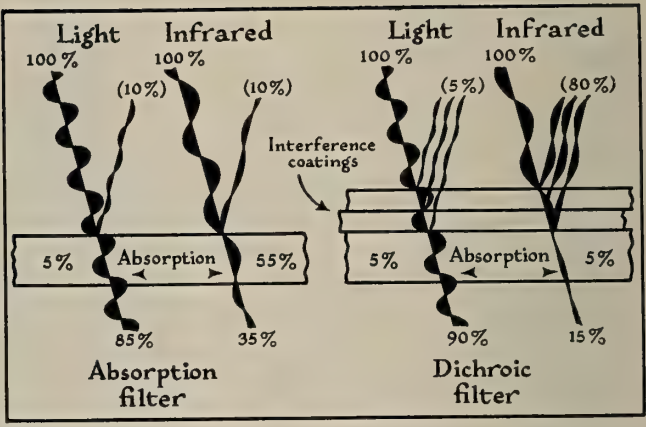


FIG. 2—Dichroic (interference) heat filters are more efficient than absorption-type filters.

open the lamphouse door just a bit to allow some of the "raw" arc radiation emitted from the positive carbon crater to shine into the room. A peculiar "electric," rather chlorine-like, odor will be noticed wherever the radiation passes through the air. This is the smell of ozone, a triatomic form of oxygen into which the ordinary diatomic form is converted by the fierce chemistry of ultraviolet.

Infrared — "Black Heat"

The infrared component of arc radiation is the real troublemaker: it is present in large amounts, it is invisible and therefore useless to projection, and it generates a great deal of heat. Radiometric measurements indicate that about one-half of the heat in a beam of Hi-arc radiation reflected from a silvered mirror is generated by the infrared, the other half by the visible light (and the small amount of ultraviolet reflected).

It stands to reason, then, that a filtering device capable of removing all of the useless, heat-generating infrared without affecting the visible light will reduce the total amount of heat on the film to 50% of the maximum. This would effect a big improvement in projection; but, unfortunately, no heat filters yet made are quite as efficient as this.

In order to appreciate fully the problems of heat reduction in projection engineering, it must be realized at the outset that *all* radiation, including visible light, is heat-generating. We can therefore never get rid of all the heat: there is no such thing as "cold light." The most that can be done is to remove all of the invisible components of arc radiation and

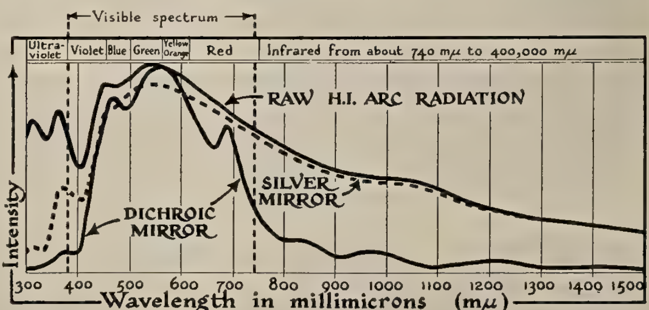


FIG. 4—The spectral-energy distribution of (a) "raw" arc radiation from a high-intensity positive carbon, (b) the radiation reflected by a silvered mirror, and (c) the radiation reflected by a broad-band dichroic mirror.

thereby get rid of approximately half of the heat to reduce film buckle, erratic focus, and emulsion damage.

Absorption Filters

The first heat filters supplied to the projectionist were of the absorption type. The principle of this type of filter is easy to understand. A yellow piece of glass looks yellow because it removes the blue and violet components of white light, leaving the red, yellow, and green to pass through. Such a yellow filter may quite properly be called a "blueviolet-absorbing filter." The absorbed blue and violet rays are turned into heat-energy which raises the temperature of the filter.

An absorption-type heat filter absorbs the rays of longer wavelengths than the red rays of visible light, that is, the infrared. The filter is made of a special glass which is more or less opaque to the infrared wavelengths, but transparent to visible light like ordinary glass. But infrared-absorbing filters are far from perfect — they absorb too much of the visible light while failing to absorb all of the infrared, — and they get so hot in the intense beam of the projection arc that they must be continually cooled by air or circulating water to prevent them from cracking.

The best absorption filters absorb 65% of the infrared and also, unfortunately, about 15% of the visible light. Because we know that half of the film-damaging heat is due to the infrared, and half to the visible light, we can calculate the total heat reduction effected by such a filter:

(1) Heat removed in 15% of visible light equal ½ x 15% equal 7.5%.

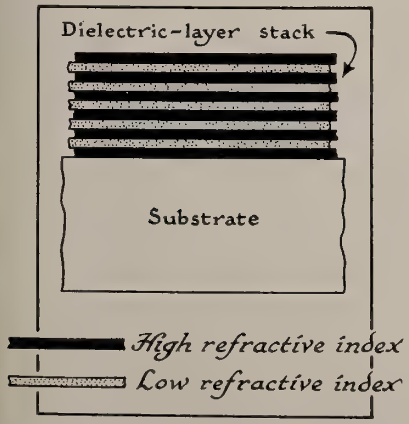


FIG. 3—Cross-sectional structure of an interference-type "cold" mirror.

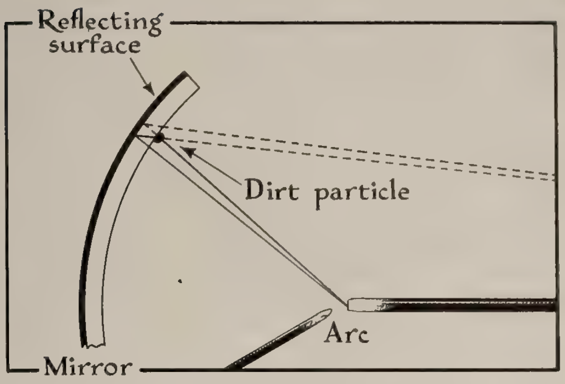


FIG.5— How a single particle of dirt on the glass surface of a 2nd-surface mirror produces the light-obscuring effect of two particles.

(2) Heat removed in 65% of the infrared equal ½ x 65% equal 32.5%.

(3) The sum of (1) and (2) equal 7.5 plus 32.5 equal 40%, the percentage of heat reduction. But, as stated above, we must suffer a light loss of 15%!

Actual measurements of aperture heat with and without absorption filters confirm this estimate of heat reduction.

"Interference" Principle

Thanks to the application of the principle of *interference,* heat filters are now availble which do a much more efficient job of removing heat from the arc-lamp beam, and without being unduly heated themselves. Now what, exactly, is "interference," and how is it used in heat filters?

Light (and all other "electromagnetic" radiations) consists of wavelike pulsations of pure energy. The wavelengths of the visible radiations are rather short, measuring only about 0.004 of a millimeter (400 nanometers*) for violet light close to the shortwave end of the visible spectrum, and about 0.007 mm (700 nm) for red light near the longwave end. Beyond the violet we find the shorter wavelengths of ultraviolet, and beyond the red we find the longer wavelengths of infrared — the troublesome "black heat."

If radiation of any wavelength (visible or invisible) is passed through an extremely thin film of transparent material, a very strange thing is likely to happen. The energy of the radiation may be completely channeled into one of two paths. It may be totally reflected back (as though the transparent film were a perfect mirror), or it may be completely transmitted without any reflection at all!

Figure 1 shows how the thickness of the thin film must be related to the wavelength of the radiation for total reflection or transmission to occur — and why.

If the thickness of the film is equal to the "crest-to-crest" wavelength of the radiation, or is equal to one-half of the wavelength, the waves reflected from the two surfaces of the film "reinforce" each other, and total reflection occurs. There is then no energy left over to be transmitted through the transparent film. If, on the other hand, the thickness of the same film is equal to three-fourths or to one-fourth the wavelength, reflection cannot occur because the reflected waves would cancel each other out. The energy must go somewhere (because the film is transparent and cannot absorb or scatter energy), so all of the radiation is transmitted. Both phenomena are examples of the interference of electromagnetic waves.

The Dichroic Effect

But there's a "catch" to this beautifully simple occurrence! White light consists of a mixture of all the wavelengths between 400 nm and 700 nm; and a thin film of any specific thickness can totally reflect only one of these many different wavelengths, or totally transmit only one other! We see this happening whenever we observe the beautiful colors of a soap-bubble or a film of oil on water: the film is so thin that interference takes place. There is no color in the film, but because some wavelengths of the white light are reflected while others are not, the light reflected back to our eyes appears to be variously colored, depending upon the varying thickness of the film.

The same phenomenon is seen in antireflection-coated lenses. The

* The term nanometer (nm) is now much used in Europe to replace the older term millimicron (mu). The prefix nano means "dwarfish," "little."

surface of such a lens is given a thin coating of magnesium fluoride (a transparent substance having a higher "index of refraction" than glass); and this coating usually has a thickness ¼ the wavelength of the color to which the human eye is most sensitive — yellow-green light of 557 nm. The result of the coating is perfect transmission, without reflection, of this wavelength, and more or less reflection of widely different wavelengths, notably blueviolet and red. For this reason the lens exhibits a purple color by reflected light.

The transmission of one color and the reflection of its complementary color by a coated lens or filter is responsible for the commonly used term "dichroic" (Greek, *di* equal "two," *chroma* equal "colors"). Some confusion occasionally arises because certain absorption-type filters which pass two narrow bands of wavelengths are also called dichroic.

Efficiency of Dichroics

By using a number of special coatings of high and low refractive index ("dielectric stack"), we can make "narrow-band" dichroics to transmit or reflect just a few selected wavelengths or "broad-band" dichroics to transmit or reflect rather wide bands of wavelengths. The interference-type heat filters and arc-lamp mirrors are of the latter type.

The interference coatings on heat filters and "cold" mirrors are very thin and easily damaged by abrasion or intense heat, though great improvements have recently been made in their toughness and stablility.

It was stated a while ago that the best absorption-type heat filters give a 40% reduction in total aperture heat with a 15% light loss. Good dichroic heat filters, on the other hand, provide a 47½% reduction in total heat with only a 10% light loss! (Reduction in visible light equal 10%, reduction in the infrared equal 85%.)

Instead of *absorbing* more than a few per cent of the infrared and turning it into heat, however, a dichroic filter *reflects* the infrared back toward the lamphouse! For this reason dichroic filters remain cooler and less liable to cracking, although there is undeniably enough absorption of heat by the glass filter-film support, or substrate, to require forced-air cooling to prevent "burning" of the films. (Fig. 2.)

Nature of Cold Mirrors

The action of the dichroic filter can be reversed by the use of differently deposited interference layers to make it reflect visible light and transmit the infared. Such a filter would actually look like a bright, silvery mirror! Now even though such a *filter* has no use in projection, an arc-lamp *mirror* made with light - reflecting, infrared-transmitting coatings is extremely valuable — nay, indispensable — for modern large-screen projection with lamps of the highest power. *Such a mirror is, in fact, the familiar "cold" mirror.*

Figure 3 illustrates the cross-sectional structure of a dichroic cold mirror, while Fig. 4 shows graphically how this type of mirror reflects visible light *while transmitting into the rear of the lamphouse* practically all of the heat-producing infrared and ultraviolet radiations.

If the coatings are placed on the back (2nd surface) of the mirror, a slight amount of light is lost by passing through the glass twice, and there is a very small — almost insignificant — reflection of infrared from the glass surface. Such a mirror, if of good quality, reduces total aperture heat by 41½%, which, although not quite as much as the 47½% heat reduction by a good dichroic filter, is actually preferable because there is no light loss, the reflectance of the 2nd-surface cold mirror being about equal to that of a silvered mirror.

For the *same* screen brightness, therefore, the silvered mirror and dichroic filter combination results in a total aperture heating of 58.-3% of maximum (100% for a silvered mirror alone), while the 2nd-surface cold mirror results in a total relative heat of 58.5%, according to the data of its manufacturer. And to get the *same* screen brightness with the cold mirror, less current is consumed in the lamp.

1st and 2nd Surface Mirrors

There are also cold mirrors having the interference coatings on the front, or 1st, surface directly facing the arc and picture mechanism. These have advantages which may be of interest to American projectionists on account of the impending availability of improved 1st-surface cold mirrors:

1. Front - coated interference mirrors reflect from 3% to 5% more light than 2nd-surface silvered mirrors.

2. They are much less liable to pitting and sooting than 2nd-surface mirrors of any type.

3. Particles of dirt on their surfaces do not obscure as much light as similar particles on 2nd-surface mirrors.

4. The reduction of total heat is 45%, which corresponds to a relative aperture heat of 55%, about 3% less than with 2nd-surface dichroic mirrors having identical coatings.

5. Because light does not pass through the glass substrate at all, there is less heating of the mirror, and dark or colored glasses of great heat resistance can be used to provide maximum insurance against breakage.

Likewise, 2nd-surface cold mirrors are not without advantages of considerable practical importance. First, a 2nd-surface mirror can be cleaned by the usual methods without danger of injuring the delicate coatings. Then too, the coatings are protected on the back by silicone varnish, so there is little danger of scratching them. The light loss caused by the light passing through the glass twice is exceedingly small, and is no different from the loss in ordinary silvered mirrors.

Why the Pink Light?

Examination of the spectrophotometric curve for the reflection of Hi-arc radiation by a cold mirror (Fig. 4) reveals that mirrors of this type are made to give maximum reflection at the wavelength of maximum visibility in the yellow-green. Accordingly, there is some transmission (and loss) through the back of the mirror of the violet and red ends of the visible spectrum. This loss, which amounts to only a very few per cent of the visible light, is magenta-pink, and can be seen shining through the mirror. Appearance of this pinkish light should not alarm the projectionist or mislead him into thinking that his cold mirror is malfunctioning or delivering discolored light to the screen. The excess of yellow-green light in the screen illumination is much too small to be seen.

Figure 5 shows how a dirt particle adhering to the front surface

of a 2nd-surface mirror (silver or dichroic) obscures more light than a similar particle on a 1st-surface mirror. To the eye such a particle of dirt, or a pit burned into the glass, looks doubled.

Early Coating Difficulties

The alternate high- and low-index interference layers are deposited upon the glass substrate of a dichroic mirror by a delicate vacuum process which necessarily makes cold arc-lamp reflectors more expensive than ordinary silvered mirrors. The first thin layer is of high refractive index, and the total number of layers is always odd. The greater the number of layers, the higher the reflectance for the "dominant wavelength" of the mirror (usually yellow-green). The following reflectance data for a simple system of ½-wavelength coatings of zinc sulfide (high index) and cryolite (low index) show that, in this particular case, the practicable maximum number of layers is eleven.

ZnS and Na_3AlF_6 System:

No. Layers	Reflectance
1 (ZnS)	31%
3	69%
5	89%
7	96%
9	99%
11	100%

Considerable difficulty has been experienced in the past with the stability of cold-mirror coatings, as the heat and powerful radiation of the carbon arc tend to have a disintegrating effect upon them. The first symptoms of such deterioration in the earlier types of cold mirror (no longer manufactured) are grayish spots of powdery appearance. These quickly grow in size, often circling the mirror after only a few months of use. In time, a 2nd-surface dichroic mirror would become grayish over much of its surface, while a 1st-surface mirror would begin to peel.

Cold Mirrors Mandatory

These difficulties have now in great measure been overcome by the use of harder interference layers and new manufacturing techniques. It may now be stated with considerable confidence that the manufacturers feel that they have licked most of their problems, and that the cold mirrors now available are satisfactorily stable — perhaps as stable as the average silvered mirror.

The new 1st-surface Strong Tufcold mirror has been improved to an unprecedented degree of perfection, mirrors of similar type showing no signs of coating deterioration or pitting by ejections from the arc after a period of use which renders silvered mirrors completely unfit because of splash-burns and pitting. The 2nd-surface Bausch & Lomb BalCOLD mirror has also been greatly improved in regard to coating stability, and is guaranteed for one year against deterioration. Properly used in good, well-ventilated arc lamps, either brand of dichroic mirror should give a very long period of satisfactory service.

The use of cold mirrors is, of course, absolutely mandatory with the most powerful arc lamps (the Strong Jetarc and the National Ventarc), and they very definitely improve projection with all high-powered lamps burning 10-mm Hi-tex or 13.6-mm regular positives (Ashcraft Super Cinex, Strong Super "135," U-H-I, and 35/70 Special, and such National lamps as the 35/70 Special and Constellation "170.") Cold mirrors reduce film buckle and improve focus while maintaining maximum screen illumination. No case of emulsion blistering has been known to occur when cold mirrors are used, no matter how powerful the arc.

All projectionists presently burning 75 amps. or more with silvered mirrors and heat filters should seriously consider the use of the new cold mirrors and eliminate the light loss of filters. The manufacturer of the lamps will gladly furnish the data needed for the correct size and type of cold mirror required, or he will be able to supply the mirrors himself.

Cleaning Cold Mirrors

Dichroic mirrors of the 2nd-surface type (BalCOLD) are cleaned the same way as silvered mirrors, that is, with a clean cloth dampened with soapy water, followed by a plain-water rinse and wiping. Bon Ami (powder) may be used if much scum be present, while a small wad of steel wool assists in the removal of splashes, burned-in cinders, or stubborn deposits of scum.

The cleaning of 1st-surface mirrors (Strong) requires a very different procedure. The interference coating is on the exposed surface; and this surface must never be scoured or scratched. However, 1st-surface dichroics are very much more immune to pitting, sooting, and scum formation. They should be very gently wiped, when dusty, with a clean, soft, dry cloth, the bulk of the dust being first brushed off. More stubborn deposits of dirt should be removed with a soft cloth dampened with lens-cleaning fluid or an aqueous solution of pure alcohol.

Six Academy Technical Awards Announced

HOLLYWOOD—Six awards and two honorable mention certificates for scientific or technical achievements were voted by the Academy Awards board from recommendations by the Scientific or Technical Awards Committee:

Douglas G. Shearer, Metro-Goldwyn-Mayer, and Robert E. Gottschalk of Panavision Inc. for developing a system of producing and exhibiting widefilm motion pictures known as Camera 65.

Wadsworth E. Pohl, William Evans, Werner Hopf, S. E. Howse, Thomas P. Dixon, Stanford Research Institute and Technicolor Corp., for the design and development of the Technicolor Electronic Printing Timer.

Wadsworth E. Pohl, Jack Alford, Henry Imus, Joseph Schmit, Paul Fassnacht, Al Lofquist and Technicolor Corp. for the development and practical application of equipment for wet printing.

Dr. Howard S. Coleman, Dr. A. Francis Turner, Harold S. Schroeder, James R. Benford and Harold E. Rosenberger of Bausch & Lomb Optical Co. for the design and development of the Balcold Projection Mirror.

Robert P. Gutterman of General Kinetics Inc. and the Lipsner-Smith Corp. for the design and development of the CF-2 Ultrasonic Film Cleaner.

Certificates signifying honorable mention went to Ub Iwerks of the Disney organization for the design of an improved optical printer for special effects and matte shots, and to E. L. Stones, Glen Robinson, Winfield Hubbard and Luther Newman of the MGM construction department for the design of a multiple cable remote-controlled winch, used to drive cables to which miniatures are attached.

STRONG ELECTRIC

Continued from Page 11

exception of reflectors which are covered by a separate warranty) for a full year period. This warranty does not include the cost of installation, which in most cases can be made by the projectionist.

Heavy duty, long life, pure silver water cooled positive carbon contacts are standard. The new water cooled carbon contact employs a one-piece water conducting tube for each contact that is fully enclosed to forego any possibility of breakage. There are no water connections at the carbon contact, no flexible tubing, or clamped or welded connections to the contact which might be subject to leakage.

A greatly increased volume of light for the exacting requirements of 70mm projection is effected by means of a beam expander lens system which shapes the spot to exactly fit the dimensional requirements of the wider aperture. "Since each frame of 70mm film is twice as wide as 35mm but of approximately the same height this reshaping of the beam is important, for simply enlarging a round spot results in tremendous loss of otherwise useful light," the Strong company points out.

With the economical full 20-inch 13.6mm positive carbon, the 1960 U-H-I projects an extra double reel of 35 or 70mm film more than projection lamps which cannot accommodate this carbon length.

The "exclusive Strong Lightronic" arc control system advances the carbons as they are consumed by means of separate Bodine geared head feed motors, to maintain a uniform arc gap length and to accurately position the positive arc crater at the exact focal point of the reflector. This control system is not an accessory but an integral part of the projection lamp. A screen light of constant intensity and color is automatically maintained without constant attention from the projectionist.

The position control system operates over the complete current range of the lamp and does not require the projectionist to reset it when changing the range of operation or when changing from 35mm to 70mm format. The function of the control cannot be thrown out of adjustment by accidental movement of the reflector. The carbon feed control can be set to burn the desired number of inches of carbon per hour, and is adjustable to the length of reels being projected. A single adjustment controls both the positive and the negative carbon feeds.

The entire burner assembly is movable in relation to the reflector so that the position of the arc can be shifted for the quality of screen light desired without disturbing the relative carbon positions or the equilibrium of the arc.

The mirror is integral with the rear lamphouse door and swings completely out of the way to facilitate retrimming and permit easy cleaning of the lamphouse and reflector. A brilliant, twice magnified image of the burning arc is projected on a large imager screen.

Free literature on the new 1960 U-H-I may be had from dealers or from the Strong Electric Corp., 31 City Park Avenue, Toledo 1, Ohio.

MONTHLY CHAT

Continued from Page 3

writer *were not* excessively loud! If the music seemed thunderous it was simply because a full orchestra playing double-forte *is* thunderous, and was *intended* to be thunderous!

What can the projectionist do to preserve his integrity as a reproducer of sight and *natural* sound in the face of overwhelming public acoustical (and musical) ignorance? This writer doesn't know! IP will be more than glad to hear from any projectionist who has met this trying challenge successfully.

INTERNATIONAL

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JULY 1960

VOLUME 35 NUMBER 7

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SALUTING STRONG ELECTRIC'S THIRD OF A CENTURY OF PROGRESS

PREVIEW OF 45th IATSE INTERNATIONAL CONVENTION — CHICAGO

INTERNATIONAL

PROJECTIONIST

Including a special Audio-Visual section relating to the operation and maintenance of A-V equipment in the educational and industrial fields.

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EAST COAST OFFICE
545 Fifth Avenue
New York 17, N.Y.
Murray Hill 7-7746

RAY GALLO
General Manager

MIDWEST OFFICE
4616 Washburn Avenue South
Minneapolis 10 Minnesota

FRANK W. COOLEY, JR.
Editor and Publisher

R. ENTRACHT
Associate Publisher

RAY GALLO
General Manager

R. A. MITCHELL
Technical Editor

In This Issue . . .

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MONTHLY CHAT

A SALUTE

This issue of INTERNATIONAL PROJECTIONIST is a special salute to the members of the IATSE immediately prior to their 45th International Convention in Chicago.

The Official Bulletin of the IATSE, in its very fine preview of the upcoming meeting at Chicago's Conrad Hilton Hotel, mentions serious problems of re-evaluation and adjustment facing our union. In addition to the increased government control over non-profit organizations such as IA, requiring considerably more detail and time in satisfying the requirements, problems particular to the motion picture machine operators will receive full attention. These include the ever-present need for slowing membership shrinkage, an dthe members' stake in helping the industry in general combat the inroads of television and pay television which are making it increasingly difficult for the industry to retain the number of operators it already has. Also to be examined is the possibility of expanding membership through the addition of operators in these newer fields.

MAGNETIC VS. OPTICAL

LIKE POLITICS and religion, projection technology is frequently pervaded by "fashionable myths" which remain unchallenged by the uncritical orthodox. And one of the most persistent bits of folklore to gain a foothold in studios and projection rooms is the belief that magnetic sound is somehow superior to optical sound, and that the latter, being longer established, is "old-fashioned."

This idea is unadulterated balderdash. Given modern, high-quality equipment, the optical-sound process reveals *by the simple test of comparison listening* that the myth of magnetic-sound "superiority" is on a level with the belief in witches and black magic. *It is a demonstrable, scientific fact that the benefits accruing from the magnetic process are very few compared with the undisputed advantages of optical sound.*

An integral part of the magnetic-sound folklore is the erroneous belief that magnetic tracks can record a wider range of frequencies than optical tracks. Actually, the frequency-range capabilities of optical tracks, both variable-area and variable-density, are greater.

It is well known that 10 octaves (or slightly less) is the maximum bandwidth that can be satisfactorily recorded and reproduced *by any magnetic-tape system.* If 30 cycles per second is the lowest sound frequency to be recorded and reproduced, the high-frequency cutoff must necessarily lie in the neighborhood of 15,360 cycles; and if the lowest frequency is 20 cycles, the highest frequency possible with a magnetic soundtrack is only 10,240 cycles.*

The optical-track process fares very much better in this respect. With modern ultraviolet recorders, thin-emulsion sound negative, and the use of a ½-mil (0.0005-inch) scanning beam in the soundhead, the high cutoff frequency of 36,000 cycles permits a nearly level output up to about 20,000 cycles at the standard track speed of 18 inches per second with no perceptible increase in noise level. And what of the low-frequency limit? It may be set as low as the amplifiers and low-frequency "woofer" speakers can

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INTERNATIONAL PROJECTIONIST

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A Technical Feature by R. A. Mitchell:

Structure and Properties of Release-Positive Films

OF PRIME IMPORTANCE to the theatre projectionist are the nature and working qualities of the film he projects. And by the term *film* we refer to perforated and processed motion-picture positive stock which consists of a plastic base coated with one or more thin layers of gelatine emulsion. Now, the terms used here are strictly projection terminology, inasmuch as "film" and "emulsion" have somewhat different meanings to the photographic engineer.

The word "film" in photographic jargon refers only to the hardened gelatine coating which carries a photographic image in the form of dispersed silver or salt grains, or as colored organic dyes. This "film" may be coated upon glass, paper, or transparent plastic; and to facilitate the formation of a coating of uniform thickness, it is applied not directly to the supporting material, but to a "substrate," or thin bonding layer, of clear pre-coated gelatine.

The substrate and gelatine film, taken together, are what the projectionist calls "emulsion" (as when he speaks of scratches in the emulsion, or of scraping off the emulsion preparatory to splicing a print). To chemists, however, an emulsion is a uniform dispersion of a very finely dividen liquid or sold in a liquid — a milky suspension of microscopic silver bromide grains in a solution of gelatine, for example. Such a solution-like emulsion of light-sensitive silver salts hardens to a pellicle — or photographic *film* — when spread out upon a smooth support material and allowed to "set" in the dark.

PROPERTIES OF DIFFERENT TYPES OF MOTION-PICTURE FILM

PROPERTY OF BASE OR FILM	5-mil CELLULOSE NITRATE	5½-mil CELLULOSE DIACETATE	5½-mil CELLULOSE ACETO-PROPIONATE	5½-mil CELLULOSE TRIACETATE	4-mil CRONAR
Tensile strength (lbs/in^2)	15,000	10,000	11,000	13,000	16,000
Elongation at break (%)	10	20	10	5	70
Tear strength (grams)	65	45	55	60	180
Rigid ity (10^5 lbs/in^2)	6.5	4.0	4.2	5.3	5.5
Flexibility (folds)	16	7	16	15	20,000
Swelling, 30 min water	0 17	0.52	0.47	0.37	0.07
Per cent shrinkage:					
2 yrs. storage	0.30	0.40	0.35	0.25	0.05
2 yrs projection use	0 60	1.5	1.	0.40	0.05
Decomposition temp F (°)	300-380	375	400	450	700
Focus drift	Moderate	Great	Great	Moderate	Slight
Buckling effects	Slight	Great	Great	Moderate	Slight
Frame embossing	Slight	Moderate	Moderate	Moderate	Slight
Brittleness tendency	Slight	V. great	Great	Moderate	None
Rel projection life	1200	400	600	1000	10,000
Solubility in solvents:					
Alcohol & ether mixt	sol	sl. sol.	insol.	insol.	insol.
Acetone	sol.	sol.	sol.	sl. sol.	insol.
Methyl acetate	sol.	sl. sol.	sol.	sl sol.	insol.
Isoamyl acetate	sol.	insol.	insol.	insol.	insol.
Acetic acid (glacial)	sol.	sol.	sol.	sol.	insol.
Dioxane	sol.	sol.	sol.	sol.	insol.
Chloroform	insol.	sl. sol.	sl. sol.	sl. sol.	insol.
Methylene chloride	sl. sol.	sol.	sol.	sol.	insol.

Photographic Emulsions

An actual photographic emulsion is made by adding solutions of silver nitrate and sodium bromide to a warm solution of gelatine. A chemical reaction occurs in which these two salts are converted to the desired insoluble silver bromide and to soluble sodium nitrate, a by-product.

Small amounts of chlorides and iodides may be introduced into the gelatine solution to make emulsions of special photographic properties, while panchromatic and infrared negative emulsions require the addition of sensitizing dyes. Without these special dyes, the film would be sensitive only to blue,

violet, and ultraviolet rays, and all yellow, orange, and red objects would photograph as black!

To make negative emulsions "faster," or more light-sensitive, they are ripened for prescribed periods of time at high temperatures before being coated upon the base material. Because the ripening process also increases the size of the silver-salt grains, the fastest films are inclined to give "grainy" images. The positive emulsions employed for release-print films are neither sensitized to the longer wave lengths of light nor ripened for increased photographic speed. They are thus "slow" and red-blind, but also remarkably fine-grained.

Properties of Gelatine

Gelatine, so necessary to the manufacture of photographic films, is an unusual substance. It can

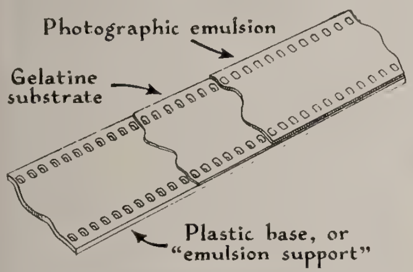

Fig. 1—Motion-picture film consists of a relatively thick plastic base upon which is coated (1) a thin transparent layer of bonding gelatine and (2) a somewhat thicker layer of photographic emulsion consisting of silver salts in gelatine. The emulsion of dye-coupler color film consists of three or more very this layers.

absorb large amounts of water without dissolving. The gelatine merely swells. Up to a limit, it can be repeatedly melted by warming and "set" by cooling.

Contrary to popular opinion, gelatine does not occur in nature. It is a derived protein made by chemical treatment of collagen, the principal protein of the connective tissue found in muscle, hide, and the ossein of bones.

Gelatine contributes to the photographic sensitivity of the silver bromide crystals, and it allows developers and other processing solutions to enter and leave the emulsion without dissolving it. It would indeed be difficult to find a satisfactory substitute for gelatine in photography.

The substrate, or thin bonding layer of gelatine directly coated upon the transparent base material is necessary because the emulsion, itself, is water-attracting, while the base is water-repelling. In order

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O **163 - A LOUISVILLE**—Andrew E. Wade, Jr., 3311 Greenwood Ave. Bus. Agt.: William Powell, 2124 Cedar St.

LOUISIANA

O **222 SHREVEPORT**—Cecil G. Parker, Sr., P. O. Box 721. Tele.: 107 Pennsylvania Ave. Bus. Agt.: N. S. Laird, 837 Linden Ave., Zone 27.

O **293 NEW ORLEANS**—Ernest J. Miranne, Sr., P. O. Box 293. Tele.: 7610 Willow St. Bus. Agt.: James E. Skelley, Jr., 2113 Selma St.

O **293-A NEW ORLEANS**—Christopher Lucien, 2711 Annette St., Zone 17. Bus. Agt.: David Segue, 2319 Upperline St.

MAINE

O**458 PORTLAND**—Leslie S. Way, P. O. Box 1894, Zone 2. Tele.: 75 Allen Ave. Bus. Agt.: Wilbur J. Vachon, 77 Read St.

MARYLAND

O **181 BALTIMORE**—Irving Whitehill, 404 W. Baltimore St., Room 3. Tele.: 3304 Parkington Ave., Zone 15. Bus. Agt.: Maurice Rushworth, 1159 Granville Road, Zone 7.

O **181 - A BALTIMORE**—Robert E. Johnson, 566 Mosher St. Tele.: 2212 Whittier Ave., Zone 17. Bus. Agt.: George H. Douglass, 901 N. Fremont Ave.

MASSACHUSETTS

O **182 BOSTON**—Ralph S. Frazier, 45 Winchester St., Zone 16. Tele.: 8 Angus St., North Quincy. Bus. Agt.: Ralph Frazier.

O **186 SPRINGFIELD**—A. J. Payette, P. O. Box 835. Tele.: 121 Wilder Terrace, West Springfield. Bus. Agt.: Edward J. O'Connor, Jr., 109 Melha Ave., Zone 4.

O **245 LYNN - SALEM**—Frank D. Halleran, 30 Chestnut St., Peabody. Bus. Agt.: L. F. Barber, 9 Shirley Rd., Lynn.

O **256 LAWRENCE**—Alfred T. Russell, 18 Norgate Road, Methuen. Bus. Agt.: Joseph Bell, 62 N. Crystal St., Ayers Village, Haverhill.

O **334 NEW BEDFORD**—Alfred A. Landry, 35 Bentley St. Bus. Agt.: Edward Patrick, 51 Newton St.

O **382 HOLYOKE**—Bus. Agt.: Edward Speight, 44 Vassar Circle.

O **397 HAVERHILL**—Edward M. Foley, 3 Maple Ave. Bus. Agt.: Edward M. Foley.

O **424 FALL RIVER**—Barber J. Faris, P. O. Box 783. Tele.: 677 Slade St. Bus. Agt.: Anthony J. Salvo, 650 County St.

O **437 BROCKTON** — Joseph K. Hooker, 25 Belcher St., Holbrook. Bus. Agt.: Raymond LaPierre, 33 Mystic St.

O **452 PITTSFIELD**—William L. Volin, 332 South St. Bus. Agt.: Edward J. Rogers, 338 Dalton Ave.

O **546 LOWELL** — John H. Marshall, P. O. Box 854. Tele.: 11 Warren Ave., Chelmsford. Bus. Agt.: Sidney Le Bow, 11 Belmont St.

MICHIGAN

O **199 DETROIT** — Jack Lindenthal, 2988 E. Grand Blvd., Zone 2. Tele.: 23147 Firwood, E. Bus. Agt.: Roy R. Ruben, 17559 Santa Rosa, Zone 21.

O **472 FLINT - OWOSSO**—Ray Field, P. O. Box 243, Flint, Zone 1. Tele.: 936 Alvord St., Flint, Zone 3, Bus. Agt.: Ray Field.

MINNESOTA

O **219 MINNEAPOLIS**—Rodolph A. Peterson, 2806 W. 88th St., Zone 20. Bus. Agt.: Frank Schilken, Jr., 825 S. Utah Ave., Zone 26.

O **356 ST. PAUL**—Charles B. Ludwig, P. O. Box 63, Zone 2. Tele.: 241 Brimhall St., Apt. 302, Zone 5. Bus. Agt.: Harold A. Miller, 2863 Stillwater Road.

O **509 DULUTH**—Russell Gran, 5714 Wadena St. Bus. Agt.: Harold G. Olson, 231 N. 4th Ave., W., Zone 6.

MISSOURI

O **143 ST. LOUIS**—Joseph A. Ellebracht, 520 N. Grand Blvd., Room 201, Zone 3. Tele.: 7711 Waddell, Zone 25. Bus. Agt.: Herbert Butz, 45 Capital Hill Drive, Zone 21.

O **170 KANSAS CITY**—Frank Dowd, 108 Railway Exchange Bldg., 705 Walnut St., Zone 6. Tele.: 1002 E. 33rd St., Zone 9. Bus. Agt.: George B. Barrett, 108 Railway Exchange Bldg., 705 Walnut St., Zone 6.

O **170 - A KANSAS CITY**—M. W. Walker, 907 Freeman Ave., Zone 1, Bus. Agt.: John Adams, Jr., 3133 N. 38th St., Kansas City, Kan.

O **447 SPRINGFIELD**—N. Dudley Mc Cann, P. O. Box 1513, S. S. Station. Tele.: 1246 Cherry St. Bus. Agt.: Elmer H. Nuttleman, 311½ E. Walnut St., Apt. 201, Zone 4.

O **465 JOPLIN**—R. L. Long, P. O. Box 465. Tele.: 910 W. First St., Webb City. Bus. Agt.: G. W. Wilson, 415 Ninth St.

O **559 ST. JOSEPH**—Ralph S. Kennard, 435 N. 17th St. Bus. Agt.: K. B. John, 1915 Washington.

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O **343 OMAHA**—R. L. McIntyre, P. O. Box 465, Zone 1. Tele.: 232 S. 28th Ave. Bus. Agt.: Clyde Cooley, 2211 Jones St.

NEW JERSEY

O **244 ESSEX COUNTY**—Bus. Agt.: Harry Shocket, 150 S. Harrison St., East Orange.

O **310 ATLANTIC CITY**—Vincent J. Sheeran, P. O. Box 572. Tele.: 600 Linden Ave., Pleasantville. Bus. Agt.: Augustius Hilton, 62 N. Delancey Pl., Atlantic City.

O **359 MERCER COUNTY**—R. Douglas Hewitson, P. O. Box 506 Trenton. Tele.: 24 Lee Ave., Trenton. Bus. Agt.: Vaughn James, 34 Jarvis Pl., Trenton.

O**384 HUDSON COUNTY**—Arthur McMahon, 130 Central Ave., Jersey City, Zone 6. Tele.: 82 Liberty Pl., Weehawken. Bus. Agt.: Ralph DeMea, 9008 Second Ave., North Bergen.

O **418 CAMDEN**—Samuel J. Berger, 224 Federal St. Tele.: 24 Park Drive, Bellmawr. Bus. Agt.: Frank Hauss, 157 Paris Ave., Audubon, Zone 6.

NEW YORK

O **233 BUFFALO**—Carl F. Patterson, 498 Pearl St., Zone 2. Tele.: 81 Delwood Road, Kenmore. Bus. Agt.: A. F. Ryde, 498 Pearl St., Zone 2.

O **253 ROCHESTER** — Walter A. Knopf, 1109 Monroe Ave., Zone 20. Bus. Agt.: Frank Coniglio, 35 Buckhaart Ave., Zone 9.

O **285 TROY**—Earl V. Cooney, Box 147, West Sand Lake. Bus. Agt.: Geo. L. Nugent, 12 Plum Ave.

O **306 NEW YORK**—Ernest Lang, 362 W. 50th St. Bus. Agts.: (New York) Steve D'Inzillo, 362 W. 50th St. (Brooklyn) Harry Garfman, 250 Ashland Place, Brooklyn, Zone 17.

O **314 SCHENECTADY**—Joseph Rogers, P. O. Box 70. Tele.: 27 Windsor Drive, Scotia. Bus. Agt.: Patrick Smith, 847 Stanley St., Zone 7.

O **324 ALBANY**—William J. Hunter, 1 Williams Court, Zone 3. Bus. Agt.: Andrew Antoinette, 677 Central Ave.

O **337 UTICA**—Rocco Monaco, 609 Steele Place, Zone 3.

O **376 SYRACUSE**—George F. Raaflaub, 108 Hunt Ave., Zone 7. Bus. Agt.: Walter Scarfe, 306 Clarence Ave., Zone 5.

O **396 BINGHAMTON**—C. E. Nicholas, 50 Court St. Tele.: Ahlberg Mobile Park. Bus. Agt.: Earl Tuttle, 39 Linden St.

O **640 NASSAU and SUFFOLK COUNTIES** — Andrew J. Marglin, 8 Turn Lane, Levittown. Bus. Agt.: William Nagengast, 18 Queen St., Freeport.

O **650 WESCHESTER and PUTNAM COUNTIES** — Michael J. Nugent, 53 S. Broadway, Room 502, Yonkers, Zone 2. Tele.: 186 Park Ave., Yonkers. Bus. Agt.: Anthony Dente, 53 S. Broadway, Room 502, Yonkers, Zone 2.

OHIO

O **160 CLEVELAND** — Victor E. Schroeder, Suite 506, Warner Bldg., 2300 Payne Ave., Zone 14. Tele.: 807 Rudyard Rd., Zone 10. Bus. Agt.: Perry L. Carter, Suite 506, Warner Bldg., 2300 Payne Ave., Zone 14.

O **228 TOLEDO**—A. F. Partis, P. O. Box 1602, Cent. Sta., Zone 3. Tele.: 804 Kipling Drive. Bus. Agt.: Harold Plumadore, 4344 Lyman Rd., Zone 12.

O **248 DAYTON**— Henry L. Woodward, P. O. Box 222, Zone 1. Tele.: 15 Birchwood Ave. Bus. Agt.: Wilmer Rousch, 2034 Malcolm Drive.

O **327 CINCINNATI**—Calvin Winder, Room 506, Palace Theatre Bldg., 12 E. 6th St., Zone 2. Tele.: 5714 Pearton Ct., Zone 23. Bus. Agt.: Earle Wagner, 3815 Edwards Rd., Norwood.

O **327 - A CINCINNATI**—Chester C. Pryor, 3016 Bathgate St. Bus. Agt.: Edward Taylor, 907 Mound St., Apt. 11.

O **352 SPRINGFIELD**— Robert W. Mills, P. O. Box 357. Tele.: 2430 Mayfair Drive. Bus. Agt.: Lloyd M. Blue, 918 Grant St.

O **364 AKRON**—S. W. Galloway, P. O. Box 364. Tele.: 177 Benson Rd. Bus. Agt.: J. A. Shuff, 133 Alden Ave., Zone 13.

O **386 COLUMBUS**—David R. Cornwell, 36 W. Gay St., Room 203, Zone 15. Tele.: 74 S. Richardson Ave., Zone 4. Bus. Agt.: Ned R. Welch, 598 Garden Road, Zone 2.

O **388 YOUNGSTOWN**—Cecil H. Cook, P. O. Box 1384. Tele.: 726 Crestview Dr. Bus. Agt.: George A. Amreihn, 217 E. Avondale Ave.

O **576 MANSFIELD**—D. K. Wiegman, P. O. Box 112. Tele.: 893 Benedict Ave. Bus. Agt.: A. F. Esbenshade. 908 Benedict Ave.

O **671 CANTON**—Ray A. Bederman, 1540 Spring Ave., N. E., Zone 4. Bus. Agt.: Russell T. Goodwin, 915 5th St., N. W.

OKLAHOMA

O **380 OKLAHOMA CITY**—R. L. Jack, P. O. Box 380, Zone 1. Tele.: 2228 W. Park Place. Bus. Agt.: Kenneth Lyons, 5105 S. Lee St.

O **513 TULSA**—Frank Piro, P. O. Box 513, Zone 1. Tele.: 1227 S. Jamestown Ave., Zone 12. Bus. Agt.: J. W. Murphy, 3248 S. Erie Ave., Zone 5.

OREGON

O **159 PORTLAND**—C. W. Christenson, 4806 S. E. 52nd Ave., Zone 6. Bus. Agt.: S. E. Philips, Box 275, Oswego.

PENNSYLVANIA

O **171 PITTSBURGH** — Luther W. Thompson, 918 B. F. Jones Building Annex, 311 Ross St., Zone 19. Tele.: 3215 Eastmont Ave., Zone 16. Bus. Agt.: James V. Sipe, 49 Calhoun Ave., Zone 10.

O **307 PHILADELPHIA**—Al Van Belle, 1317 Vine St., Zone 7. Tele.: 2116 Haverford Ave., Ardmore. Bus. Agt.: Abbott Oliver, 1317 Vine St., Zone 7.

O **307 PHILADELPHIA**—Herman K. Williams, 5925 N. 21st St., Zone 38. Bus. Agt.: Charles Polk, 15 S. Ruby St.

O **325 WILKES - BARRE**—Kenneth A. Thomas, 91 Downing St., Plymouth. Bus. Agt.: Kain Jacobs, 197 Old River Road.

O **329 SCRANTON**—Clayton R. Leas, P. O. Box 228. Tele.: 2923 Frink St. Bus. Agt.: Sam Kessler, 512 Wheeler Ave.

O **411 WILLIAMSPORT**—Harold B. Lilley, P. O. Box 411. Tele.: 1218 Vine Ave. Bus. Agt.: Glenn Crossley, Sr., 2381 Riverside Drive, South Williamsport.

O **488 HARRISBURG**—E. Richard Bennett, P. O. Box 1258. Tele.: 317 S. Front St. Bus. Agt.: Sam Rubin, 4405 N. Front St.

O **585 ALLENTOWN**—Harry C. Hohl, P. O. Box 1205. Tele.: 2119 Washington St. Bus. Agt.: LeRoy Rau, 235 Water St.

O **621 ERIE**—Gerald E. Brunson, P. O. Box 435. Tele.: 2540 Colonial Ave. Bus. Agt.: Edward P. Krayer, 3506 Cherry St.

O**661 READING**—Le Roy Wagner, 389 Oak Terr., West Reading. Bus. Agt.: Le Roy Wagner.

O **682 LANCASTER**—Laird A. Hall, P. O. Box 645. Tele.: 111 S. Pearl St. Bus. Agt.: Laird A. Hall.

RHODE ISLAND

O **223 PROVIDENCE** — Sydney T. Clarke, P. O. Box 683, Zone 1. Tele.: 1 Goodall Pl., Riverside, Zone 15. Bus. Agt.: H. F. Slater, 675 County Road, Barrington.

SOUTH DAKOTA

O **556 SIOUX FALLS**—Roy E. Munson, P. O. Box 327. Tele.: 932 N. Spring Ave. Bus. Agt.: Executive Board, % K. L. Lewis, 1603 S. 10th Ave.

TENNESSEE

O **144 MEMPHIS**—J. W. McAfee, P. O. Box 947, Zone 1. Tele.: 4704 Coro Rd., Zone 9. Bus. Agt.: A. G. Shelton, 191 Elm Ave.

O **259 CHATTANOOGA**—B. N. Vick, P. O. Box 1002. Tele.: 4832 Hunter Trail. Bus. Agt.: Robert Lowry, 109 E. Brainerd Rd.

O **405 KNOXVILLE**— C. V. Warwick, P. O. Box 974. ele.: New Beverly Ch. Road. Bus. Agt.: John McLean, Route 5, Lakeland Drive, Lenoir City.

O **626 NASHVILLE**—W. J. Brown, P. O. Box 626, Zone 2. Tele.: 2210 12th Ave., So. Bus. Agt.: Ben Thomas, 1240 Warner Ave.

TEXAS

O **249 DALLAS**—Harvey D. Hill, Jr., P. O. Box 1584. Tele.: 4319 Hall. Bus. Agt.: Earl A. Holt, 507 Aqua Drive.

O **249 - A DALLAS**—S. R. Tankersley, 2409 South Blvd. Bus. Agt.: S. R. Tankersley.

O **279 HOUSTON** — J. M. Kirklin, 1815 Walker Ave., Zone 3. Bus. Agt.: E. J. Miller, 1815 Walker Ave., Zone 3.

O **279 - A HOUSTON**—Willie Monie, 3272 E. Alabama Ave., Zone 4. Bus. Agt.: Willis W. Beal, Jr., 3002 Chimira Lane, Zone 20.

O **305 GALVESTON**—W. M. Scott, P. O. Box 305. Tele.: Rt. 1, Box 272x, Hitchcock. Bus. Agt.: A. J. Warren, 4415 Ave. R.

O **330 FORT WORTH**—B. Y. Coffman, P. O. Box 543, Zone 1. Tele.: 7348 Grapevine Hgwy. Bus. Agt.: V. O. Huffines, 509 Haynes St.

O **407 SAN ANTONIO**—Henry Villapadierna, P. O. Box 501. Tele.: 1509 N. W. 23rd St. Bus. Agt.: John D. Dennis, 224 E. Courtland.

O **597 WACO**—Charles J. Keeler, P. O. Box 1183. Tele.: 2620 Dutton Ave. Bus. Agt.: C. L. Holt, 326 N. 30th St.

UTAH

O **250 SALT LAKE CITY**—W. P. Nelson, 4433 S. 970th East. Bus. Agt.: James F. Sullivan, 2237 Broadmor St.

VIRGINIA

O **370 RICHMOND**—Howard S. Powers, Jr., P. O. Box 1681. Tele.: R. F. D. No. 8. Bus. Agt: John W Aders, 105 N' Allen Ave.

O **370 - A Richmond**—Allie Laury, Capital City Lodge, 312 W. Clay St. Tele.: 502 S. Harrison St. Bus. Agt.: Allie Laury.

O **550 NORFOLK**—J. M. Fowler, P. O. Box 632. Tele.: 122 Winshire St. Bus. Agt.: Alonzo T. Hughes, 56 Chatham Rd., Portsmouth.

O **550 - A NORFOLK**—George E. Mitchell. P. O. Box 1942. Tele.: 3105 Schooley Ave. Bus. Agt.: J. P. Omohundro, 1440 Proescher St.

WASHINGTON

O **154 SEATTLE**—Ed Hird, Room 124, Labor Temple, 2800 1st Ave., Zone 1. Tele.: 7623 S. 128th St. Bus. Agt.: James McNabb, Room 124, Labor Temple, 2800 1st Ave.

WEST VIRGINIA

O **500 CHARLESTON**— Norman L. Kersey, P. O. Box 5. Tele.: 8406 Virginia Ave., Marmet. Bus. Agt.: Executive Board, P. O. Box 5.

WISCONSIN

O **164 MILWAUKEE**—Oscar E. Olson, 454 Cawker Bldg., 108 W. Wells St. Bus. Agt.: Oscar E. Olson.

Ashcraft Develops New Lamp For the "Average-Size" Theatre

Two new type projection lamps have been developed, and are now made available, by C. S. Ashcraft Mfg. Co. Inc. These lamps were designed to provide the "average" size theatre with the same perfect projection for either 35mm or 70-mm that the Ashcraft 35/70mm Super Cinex has so outstandingly accomplished for the largest palaces and largest drive-in theatres throughout the world. These lamps are, of course, much lower in price and operating expense. That is, carbon and current cost is much less. Yet the two qualities necessary for projection perfection, screen light intensity and screen light distribution, exceed that of any existing or previous type of lamps made for the average theatre, the company hlaims.

Actually these new projection lamps cover the complete range of three types of theatres. (1) The smaller than average theatre using 35mm film only, where the 10mm carbon and 16" silver reflector suffice. (2) The average or medium size theatre using 35mm film only but requiring the 11mm carbon with either the 16" or 18" cold reflector. (3) Those theatres requiring both 35mm and 70mm projection, in which case the 13:6mm carbon and 18" cold reflector are necessary.

Higher Optical Speeds

For all three types of theatres, higher speed lamp optics are one of the outstanding features. For 35mm film, the old standard of F/2.0 mirror optics has been increased to F/1.6 increasing the screen illumination up to 50%, with the same arc current, while the screen light distribution is also greatly improved.

Those lamps restricted to 35mm film projection are designated as "Cinex 35" projection lamps, while the Ashcraft "Cinex 35/70 Special" lamp using currents in the 130 - 135 ampere range will project either 35mm film or 70mm film with equal efficiency and have an optical speed of F/1.5.

To obtain these extremely high speeds without limiting the length of carbon used, the "Cinex 35/70 Special" is provided with a new split type light cut-off douser through which the carbon may extend and still effectively cut off the light projected to the film.

It is the opinion of leading projection engineers that intense water cooling is far preferable to any type of air cooling. This applies equally well to both carbon jaw cooling and cooling of the projector aperture. The Ashcraft Cinex 35/70 Special therefore cools the carbon contact jaws by means of forcing cold water through hollow pure silver contact blocks directly in contact with the carbon itself (not by secondary cooling which has previously been used in many lamps,) the company says.

Design Lowers Costs

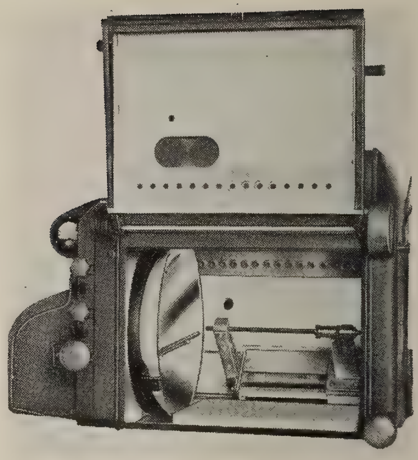
The simplicity, durability and perfection of operation of the Ashcraft "Super Cinex" burner mechanism is well known and recognized by the entire motion picture industry. The identical burner mechanism, with every shaft mounted on roller or ball bearings, with identical water cooled carbon jaws and carbon rotating mechanism, is used in the new "Cinex 35/70 Special."

The standardization of unit design of the Cinex 35/70 Special with that of the Ashcraft Super Cinex 130-165 ampere lamp allows a minimum of design and manufacturing expense. This saving is being passed on to the ultimate buyer — the theatre owner. Thus the price of the Cinex 35/70 Special is substantially lower than that of other lamps of the high intensity-rotating carbon-reflector type the Ashcraft firm points out.

The Cinex 35/70 Special is the most versatile and wide-range lamp ever designed. It is also the most modern, compact, efficient and economical high quality projection lamp yet to be made available for all classes of theatres in the "average" range they say.

For the larger theatres, the Ashcraft "Super Cinex 35/70" still

Cinex Special



Lamphouse Open

remains king in the Ashcraft line of projection lamps.

As a complementary power source for the new "Cinex 35/70 Special" and "Cinex 35" lamps the C. S. Ashcraft Mfg. Co. Inc., has designed a new 12 phase, High Reactance 70-135 rectifier of the highest quality yet in the low priced range. Completely insulated with Daglass wire and glass insulation the transformer is practically indestructable. Being of the special high reactance type, no troublesome so-called current minimizers are necessary. The design is such that upon striking the arc, the arc voltage is reduced to near zero and the current surge reduced to a low value. As the carbons are separated the arc voltage automatically increases to normal. In this way all units of the rectifier are fully protected from damaging high current and voltage surges.

Unlike ordinary rectifiers all units are moisture proof and require no reforming after long periods of inactive lay up.

No Crater Damage

One of the fine features of this rectifier is that there can be no damage to the crater tip of the positive carbon or pitting of the reflector when striking the arc. The inherent minimizing of arc current and voltage reduces the "blasting" effect caused by the short circuiting of the carbons which is common to ordinary low reactance rectifiers.

The ripple content (inherent ripple modulation) of the 12 phase Ashcraft High Reactance rectifier is reduced to approximately 1%, whereas 3 phase type (low reactance) is 5%. This quality combined with the fact that there are 720 current pulsations per second, as compared with only 360 pulsations in low reactance 3 phase rectifiers, moderates the arc current flow, creating a smooth, flickerless light emission from the carbon crater.

Observing a . . .

Strong Electric Continues the work of Projection Pioneer Harry H. Strong

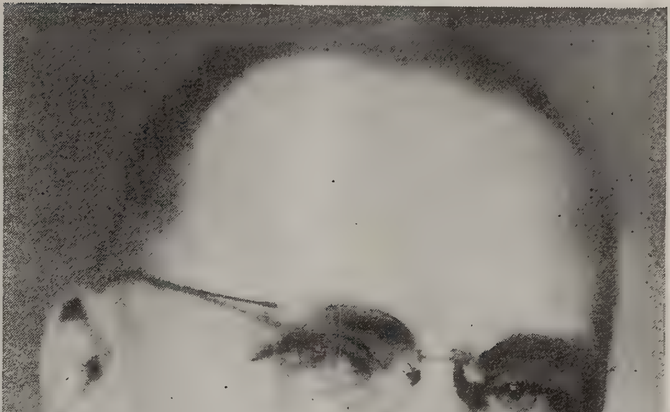
by R. A. MITCHELL

Technical Editor

International Projectionist

STILL MAINTAINED in the Toledo, Ohio headquarters of the Strong Electric Corporation is the office of Harry H. Strong. The door is open, and the visitor may step inside for a moment of thoughtful reflection. Those who knew Harry Strong personally will miss the extended hand of greeting and the friendly voice; but there is certainly no absence of his continuing identification with progress in projection technology. The trail-blazing work to which he devoted his outstanding engineering talents from the days of the silent movies until his death in 1956 continues without interruption under the direction of Arthur J. Hatch, president of the corporation founded by Harry Strong a third of a century ago.

Harry Strong was truly the projectionist's friend. As an equipment maintenance engineer in the early nineteen-twenties, he became intimately acquainted with the projectionist's problems. In those days it was necessary to feed the carbons of the arc-lamp with one hand while cranking the projector with the other! And the lamp had to be kept burning for the slides which were usually screened between reels.



Harry H. Strong

This was an intolerable state of affairs; and Harry Strong set about to devise an effective remedy.

Strong's motor-driven automatic arc control created a sensation. By attaching it to the feed mechanism of a vertical-arc lamphouse, it maintained the correct arc gap and relieved the projectionist of the most irksome of his numerous duties. But this was only the beginning. From that day on, the creative engineering of Harry Strong not only paralleled the development of the growing motion-picture art, but was often a few jumps ahead of it!

The first Strong projection lamps were built in 1925. Inspired by a small German burner mechanism which made it possible to convert a 50-ampere vertical-arc condenser lamp into a crude coaxial-carbon reflector lamp giving the same amount of light at only 15 amperes, Harry Strong improved upon the idea and produced a pair

. . . Third of a Century of LIGHT

of automatically controlled low-intensity reflector lamps. These were installed in the East Side Auditorium, Toledo, and were probably the most advanced and satisfactory projection arc-lamps of that day.

The first Strong lamps were assembled in the usual square, box-shaped lamphouses then used for the vertical-arc condenser lamps. In 1926, however, Strong added "eye appeal" to his product by employing the streamlined cylindrical-type lamphouse which has remained in favor right up to the inception of the most modern high-intensity mirror lamps.

The following year marked the beginning of Strong Electric as a recognized corporate manufacturer of arc-lamps. In 1927, also, a smaller model of the Strong Standard low-intensity reflector lamp, called the Strong Junior, was designed to enable the smaller theatres to replace their obsolete, power-wasting vertical arcs.

The Strong Electric Corporation embarked upon its career as the leading manufacturer of lamp equipment and companion rectifiers in a modest loft building, from which it soon moved to vacant rooms over a tinsmith's shop. The next move was made to a larger building which was originally a motion-picture theatre, and finally, in 1942, to its present modern plant at 87 City Park Avenue in Toledo.

In the days of silent movies the larger theatres required Beck, or ate their large screens. The lamps for HI carbons were of the condensing-lens type, and were very expensive to buy and operate. By designing a high-intensity *mirror* lamp, Harry Strong brought the brilliant, daylight-white light of the Beck arc to hundreds of theatres which could not afford condenser-type HI lamps. The Strong Hy-Lo lamp introduced in 1928 projected as much light at 60 amps. as old condenser HI lamps at 120 amps. — "high in intensity, low in cost."

The Hy-Lo lamp was an extremely important item of equipment when the introduction of Technicolor demanded snow-white screen light and the advent of sound required the use of perforated screens. Without this HI mirror lamp, the loss of light caused by the "sound holes" in the screen would have been disastrous for many theatres.

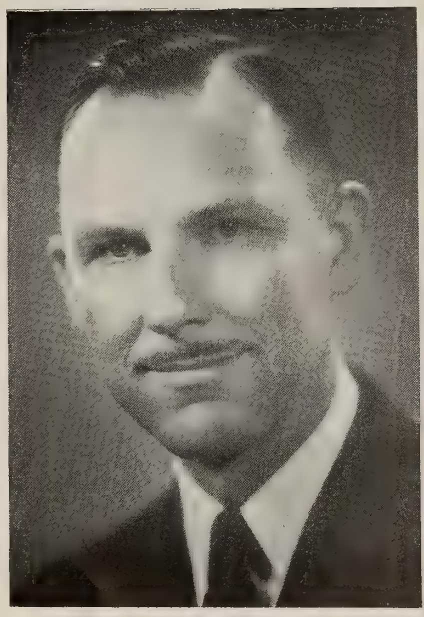
From then on events moved rapidly for Strong Electric. The year 1930 saw the introduction of a 15-amp. LI portable mirror lamp which still enjoys wide use on such portable 35-mm projectors as the Simplex SP. An economical alternating-current lamp, the Strong AC Mogul, was made in 1932 to provide the smaller theatres with the snow-white light needed for color pictures. Development of copper-coated "Suprex" HI carbons in 1933, however, spelled the doom of the AC lamp, which gave a flickering light when operated on 60-cycle current. The new Suprex carbons opened the era of the tremendously popular "simplified high-intensity" mirror lamp.

It was in 1934 that Harry Strong produced his first Suprex-type lamp—the Strong DC Mogul. The great success of this lamp cannot be overstated. This was a lamp which delivered the same bright, white light of the older Hy-Lo at the same current of 60 amps., and with greater economy of operation. High-intensity lighting had at last been made a practical reality for theatres of moderate size.

In order to be assured of reflectors of the highest quality for their lamps, the Strong Electric Corporation established in 1935 an optical department in which reflectors were mathematically computed, the glass blanks formed, and the mirrors ground, polished, and silvered—every step from the raw glass to the finished reflector.

It has been estimated that there were only about 4000 theatres equipped with HI lamps during the period 1938-1940. The very smallest theatres couldn't afford even the 60-amp. Strong Mogul Suprex lamp!

After the expenditure of sweat and tears—and "profanity and almost blood"—Strong engineers had designed a successful low-powered HI lamp for 16-mm projection, a lamp which is still popular, and even absolutely necessary for theatre-quality 16-mm pictures. The next engineering step was the design of a low-powered Suprex lamp for 35-mm projection.


A. Hatch


L. Nelson

The result was the Strong One Kilowatt Utility lamp first manufactured in 1940. This lamp successfully burned copper - coated carbons at a current as low as 40 amps., and provided brilliant, daylight - white projection on screens up to 18 feet in width. The Utility lamp, other, sounded more than any the death - knell of muddy yellow low - intensity lighting, as did, also, the similar Strong Victory lamp built during the war years with a minimum of aluminum, copper, and other strategic materials.

Strong Electric rendered valuable service to the Nation and its Allies during World War II by manufacturing sonar equipment and special-purpose military searchlights. Further expansion of Strong's activities included the manufacture of graphic-arts equipment in 1946, the now well-known Strong Trouper and Trouperette spotlights (which first appeared in Harry Strong's enswer was the 1948), and arc and solar furnaces for education and research.

Came 1949, the drive-in theatre, and the pressing need for larger, more powerful, projection lamps. Harry Strong's answer was the Mighty 90, a wholly new concept in HI arc-lamps. Fitted with a large-diameter mirror to match the new high-speed projection lenses, the

Mighty 90 burned rotating positive carbons with the negative inclined at an angle to insure a stable arc. The tail-flame was controlled by a jet of air, rather than by the usual magnetic system; and for the first time the advance of the carbons and the position of the crater were continuously regulated by the auxiliary optical system and light-sensitive cell of the Strong Lightronic arc control.

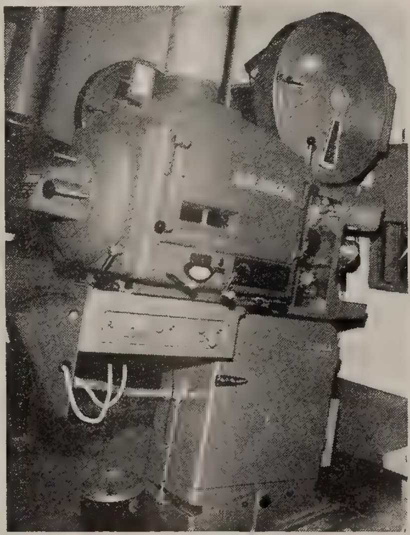
Screen sizes continued to increase with the building of larger drive-ins and the coming of CinemaScope and other wide-screen projection systems, so to meet the demand for more and more light, the Strong Super-135 was introduced in 1953. Whereas the Mighty-90 burned currents from 75 to 105 amps., the more powerful Super-135 could burn up to 135 amps. And the introduction of 70-mm films spurred the development of still another Strong giant, the U-H-I (Ultra High Intensity), a lamp employing new, more effective cooling means and permitting unprecedented amounts of light to pour through aperture and film to the screen.

The year 1956 brought an event which saddened projectionists throughout the world. Harry H. Strong died at his home in Toledo May 3 at the age of 69. A fruitful 30-year career as an outstanding designer and leading manufacturer of projection-lamp equipment had come to an end. But even though there is no longer a Harry Strong, his traditions are being maintained by the men who knew him best, the men who worked with him over the years.

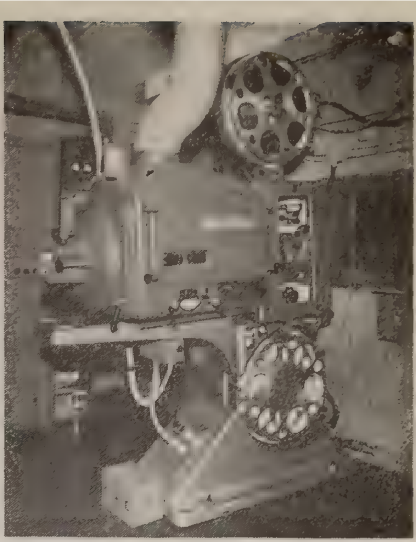
The Strong Electric Corporation's quest for more and better screen light continued apace—Harry Strong would have wanted it that way. He would have been proud of his company's successful application of the 3-dimensioned, cylindrically shaped "blown arc" to the requirements of motion-picture projection. The amazing new Strong lamp, the most powerful ever offered to the industry, was the Jetarc, which made its debut in 1958. With its 21-inch "cold" mirror, the Strong Jetarc delivers up to 56,000 lumens with the wider apertures—more than double the maximum light of any reflector lamp using a $16\frac{1}{2}$-inch mirror! At last the screens of the largest drive-ins could have "indoor-quality" pictures projected upon them!

Still another new lamp—one specifically designed for the dual requirements of 35-mm and 70-mm projection—was produced in 1959. This, the Strong 35/70 Special, enables the different gauges of film to be projected at maximum optical efficiency without the need of changing mirrors. This brings us to the present year of 1960 and to another new lamp from Strong, namely, an improved model of the U-H-I having a completely redesigned lamphouse of greater compactness for easier installation in projection rooms having low ceilings.

The Strong 1960 U-H-I lamp burns the economical full 20-inch



Shown is the recent installation of Strong "35/70 Special" projection arc lamps on Victoria X projectors at the Esquire Theatre, Dallas, Texas, for the presentation of 70 mm film productions.



Shown is an installation of Strong "35/70 Special" projection arc lamps on Phillips Norelco projectors just made at the Hollywood Theatre, Portland, Oregon, for the presentation of 70 mm productions.

13.6-mm black positives for an *extra* double reel of 35-mm or 70-mm film. The ventilation system uses 70 per cent more air for a cool lamphouse even after hours of operation. The Hydro-Tite water-cooled carbon jaw employs a fully enclosed one-piece tube which eliminates all risk of breakage—no water connections at the carbon burner, no flexible tubing, no clamped or welded connections! And the projectionist is relieved of constant supervision of the arc. Two separate Bodine geared head-feed motors and Lightronic automatic control insure a constant arc gap and a constant focal positioning of the positive crater. Brother, the U-H-I fills your screen with the brightest, whitest light and works like a charm!

The Strong 1960 U-H-I lamp is a far cry from Harry Strong's automatic control made with a vacuum-cleaner motor in 1923 to relieve projectionists from the necessity of continually turning the feed knobs of their old vertical arc-lamps by hand to avoid a blackout on the screen! And yet

Continued on Page 14

THE FIRST STRONG PLANT

STRONG ELECTRIC CORPORATION PLANT — 1960

Coincidental with the observance of ...
in arc lamp development started by Harry H. Stro...
Strong Electric Corporation announces the development of—

The New 1960 Mod...

THE ...MAN SHOP WHERE IT ALL STARTED

QUICKLY ADAPTABLE TO EFFICIENT PROJECTION OF 35 MM AND 70 MM FILM WIDTH

The totally new Airscope ventilating system, effectively using 70% more air for cooling, is more efficient than that of previous projection lamps.

A complete change of ... is effected every five secon... Although having a capacity of 1... amperes, the lamphouse, back d... assembly and operator side d... maintains a 30° lower operat... temperature.

The
STRONG ELECTR...
Corporation
31 City Park Avenue
Toledo 1, Ohio

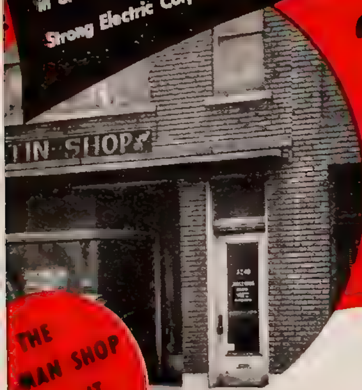
Full Year Warranty

The maintenance cost of the 1960 U·H·I promises to be much lower than that of any previous high powered projection lamp. Friction in all driving parts has been reduced to a minimum so that the working load on carbon feeding drives has been greatly decreased thus adding to the reliability and further insuring freedom from unexpected failure due to overloads.

All parts, heretofore considered to be expendable, have been so improved in design and quality of construction that Strong is guaranteeing to replace without cost any non-abused parts (with the exception of reflectors which are covered by a separate warranty) for a full year period.

Coincidental with the observance of ... in arc lamp development started by Harry H. Strong ... Strong Electric Corporation announces the development of—

The New 1960 Model U·H·I PROJECTION LAMP



THE TIN SHOP WHERE IT ALL STARTED

QUICKLY ADAPTABLE TO EFFICIENT PROJECTION OF 35 MM AND 70 MM FILM WIDTHS

The totally new Airscope ventilating system, effectively using 70% more air for cooling, is more efficient than that of previous projection lamps.

A complete change of air is effected every five seconds. Although having a capacity of 165 amperes, the lamphouse, back door assembly and operator side door maintains a 30° lower operating temperature.

The STRONG ELECTRIC Corporation
31 City Park Avenue
Toledo 1, Ohio

Full Year Warranty

The maintenance cost of the 1960 U·H·I promises to be much lower than that of any previous high powered projection lamp. Friction in all driving parts has been reduced to a minimum so that the working load on carbon feeding drives has been greatly decreased thus adding to the reliability and further insuring freedom from unexpected failure due to overloads.

All parts, heretofore considered to be expendable, have been so improved in design and quality of construction that Strong is guaranteeing to replace without cost any non-abused parts (with the exception of reflectors which are covered by a separate warranty) for a full year period.

DOUBLE THE AIR COOLS THE REFLECTOR

A constant curtain of cool air flows over both faces of the cold type reflector to result in a uniform temperature over the entire mirror, greatly reducing thermal stresses that could cause reflector failure. One hundred percent more air is swept over the reflector in the 1960 U·H·I than in other lamps.

SMOKE AND SOOT BANISHED

Smoke and soot within the lamphouse are instantly withdrawn so that any which would ordinarily be deposited on the reflector is eliminated, thus retarding mirror deterioration and further reducing the liklihood of thermal stress damage.

EASY TO INSTALL

The new ventilating system has made possible the design of a streamlined silhouette which is 25% lower than that of other lamps of the same class. This dimensional change permits easy installation even in projection rooms with low ceilings. There is no need to revamp the prevailing booth exhaust system if it has been adequate for use with lamps operating at 90 amperes or higher.

NEW HYDRO-TITE WATER COOLED CONTACTS

Heavy duty, long life, pure silver water cooled positive carbon contacts are standard. The new Hydro-Tite water cooled carbon contact is an ingenious development of a simple clean design. It employs a one-piece water conducting tube for each contact, that is fully enclosed to forego any possibility of breakage. There are no water connections at the carbon contact, no flexible tubing, or clamped or welded connections to the contact, any of which might be subject to leakage.

APERTURE SPOT SHAPED FOR MAXIMUM SCREEN LIGHT

A greatly increased volume of light for the exacting requirements of 70 mm projection is effected by means of a beam expander lens system which shapes the spot to exactly fit the dimensional requirements of the wider aperture. Since each frame of 70 mm film is twice as wide as 35 mm but of approximately the same height, this reshaping of the beam is important, for simply enlarging a round spot results in tremendous loss of otherwise useful light.

THE STRONG ELECTRIC CORPORATION PLANT TODAY

PERMITS GREAT CARBON SAVING

With the economical full 20-inch 13.6 mm positive carbon, the 1960 U·H·I projects an extra double reel of 35 or 70 mm film more than projection lamps which cannot accommodate this carbon length.

SINGLE ADJUSTMENT CONTROLS BOTH CARBON FEEDS

The carbon feed control can be set to burn the desired number of inches of carbon per hour, and is adjustable to the length of reels being projected. The 13.6 mm positive can be burned at from 7 to 22 inches per hour as desired.

EASY SPOT FOCUSING

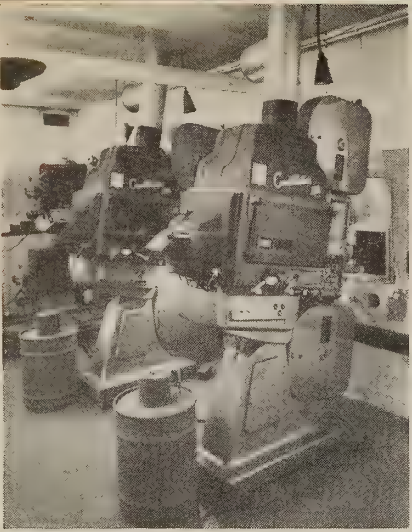
The entire burner assembly is movable in relation to the reflector so that the position of the arc can be shifted for the quality of screen light desired without disturbing the relative carbon positions or the equilibrium of the arc.

EASY TO TRIM — EASY TO CLEAN

The mirror is integral with the rear lamphouse door and swings completely out of the way to facilitate retrimming and permit easy cleaning of the lamphouse and reflector. A brilliant, twice magnified image of the burning arc is projected on a large imager screen.

EXCLUSIVE [illegible] AT NO EXTRA [illegible]

This arc control system—not an accessory but an integral part of the projection lamp—advances the carbons as they are consumed by means of separate famous Bodine geared head feed motors, to maintain a uniform arc gap length and to accurately position the positive arc crater at the exact focal point of the reflector. A screen light of constant intensity and color is automatically maintained without constant attention from the projectionist. The position control system operates over the complete current range of the lamp and does not require the projectionist to reset it when changing the range of operation or when changing from 35 mm to 70 mm format. The function of the Strong position control cannot be thrown out of adjustment by accidental movement of the reflector as the control works independently of the projected beam.



Shown is an installation of Bauer projectors and Constellation "170" projection arc lamps just completed at the Center Theatre, Salt Lake City, for the presentation of 70 mm film productions.

STRONG ELECTRIC

Continued from Page 11

the spirit motivating the creation of Strong's first arc control is the same desire to produce the very best which is built right into every Strong lamp from the oldest to the latest.

'Challenge of '60's' NAVA Meet Theme

"The Challenge of the Sixties" will be the theme of the 20th Annual National Audio-Visual convention to be held at the Morrison Hotel, Chicago, Aug. 6 through 9, 1960, according to an announcement by William G. Kirtley, president of the National Audio-Visual association.

The NAVA Convention and Exhibit annually brings together better than 2500 people from the audio-visual field, including dealers, manufacturers, producers, plus several groups of audio-visual users. During the Chicago meeting they have a chance to both view the new and remodeled products of the industry and hear business spokesmen chart trends and discuss A-V problems.

Plans are well underway for a diversified convention program according to Kirtley. Attention will be directed during the program to audio-visuals in industry and business as well as the school and church markets. The exhibit is also expected to again feature the world's most complete display of audio-visual equipment and materials.

NEW PROJECTOR AIDS OLD PICTURE QUALITY

General Electric Co. will market a continuous television film projection system which is said to "inject new life into old films."

Designed by Eastman Kodak Co. for G-E, and for use with the Vidicon camera, the projector incorporates a new diffused light system. It practically eliminates the effects of scratches and dirt particles on 16mm films and projects a steadier image on the screen.

Monthly Chat

Continued from Page 3

handle, inasmuch as there is no connection whatever in the optical-sound process between the low- and high-frequency response limits.

As a matter of everyday fact, 20,000 cycles can be recorded optically even on 16-mm film, which has a linear rate of travel only 0.4 that of standard film! Experience in the production of 16-mm TV "kinescopes" has shown that the quality of 16-mm optical tracks *in prints* is limited only by the quality of the original magnetic recordings, when these are used; and the quality of the magnetic originals is not always good because of tape "dropouts" and wear or maladjustment of the re-recording heads.

We, as projectionists, are concerned only with the recording of sound in the various media, not with video recording. Nevertheless, it is worthwhile to bear in mind that the frequency requirements of videotape recording are actually less severe than those of sound recording. Here is why:

Sound records require a bandwidth of at least 10 octaves (30—15,000 cycles) for high fidelity. Video records, if these be frequency-modulated in accordance with present-day practice, require a bandwidth of only 4 octaves. The defects of taped TV shows are just as likely to be apparent in the sound as in the picture.

It is even more interesting to note that TV video recording both by the electro-thermoplastic process (IP for May,p. 14 *et seq.*) and *photographically* on standard film by an ultarsonic light-modulation method yield results superior to those obtained from magnetic video tape.

One of the peculiarities of the magnetic recording process is that the gap width of the recording head is not very important, while that of the reproducing head is extremely critical. This means that while acceptable records can be obtained even with badly worn recording heads, a reproducing head which is only slightly worn gives intolerably bad sound. And bad magnetic sound is *really bad*—much worse than bad optical sound, and usually worse than disc records played with worn needles.

The advantages of magnetic recording in motion-picture production reside largely in the low noise level of taped records, permitting a large number of re-recording and dubbing steps to be carried out without unduly increasing the background noise. However, unless the reproducing heads of the transfer apparatus be in top-notch condition, the quality of the resultant final sound record will be low indeed.

On the whole, it cannot truthfully be said that magnetic recording is superior qualitywise to modern high-grade optical recording; and there is engineering evidence which indicates that motion-picture sound might be improved by the use of split-track push-pull optical originals. These also have the advantage of low noise level.

The simplicity and absence of "photocell hiss" are the principal factors responsible for the adoption of magnetic tracks for CinemaScope theatre-release prints having stereophonic sound. But more than anything else, the use of magnetic tracks in theatres has revealed the intolerable effects of worn magnetic reproducing heads and the astonishing reluctance of exhibitors to meet the ordinary operating costs of the projection room.

Optical stereophonic sound by the subsonic control-frequency method is feasible, as the now defunct Perspecta Sound process proved; but it appears doubtful to many observers whether stereophonic sound is a worthwhile addition to regular-release motion pictures. More realistic and less distracting results can be obtained, in the opinion of many qualified critics, by the use of single-channel sound piped to multiple speaker units for a non-directional effect.

Even though the present types of optical track are generally of higher quality than the magnetic tracks on CinemaScope release prints — and are certainly more dependable and less expensive, — such optical-sound improvements as the use of noiseless lead sulfide photocells and push-pull tracks on release prints bid fair to relegate magnetic sound to oblivion in the exhibition field. R.A.M.

ElectroCarbon President Supervises Rome Research

Lee Artoe, president of Electro-Carbons, was in Milan, Italy, supervising laboratory research on Roman Mirio Cinema Carbons. Already announced is the development of an absolutely new process for packing the core into the mantle which provides 10-15% greater light. Artoe extended his stay at the manufacturing plant, Electrocarbonium, S.P.A., Milan, Italy, for additional experiments.

New GE System Uses "Light Valve"

The new electronic large-screen projection system developed by General Electric Company combines high-speed data acceptance, instantaneous (real-time) display, color, maximum picture quality, a wide range of image throw-distances. It is the first system ever built that combines all of these capabilities, the company says.

The system can accept processed data or live television images for large-screen display and is self-contained except for power supplies. The cabinet for one of the models measures 63.25 inches high, 41.25 inches deep and 25 inches wide.

Outside the military field, the projection system can be used in medical, educational, commercial and industrial applications.

In the light-modulation process employed in the Light Valve projector, a special control layer modulates the light from a high-intensity Xenon lamp. The optical characteristics of the control layer are changed by a beam from an electron gun, which is controlled by the input signal.

The projection system produces a picture with high geometric accuracy and allows flexibility in screen size and projection distance, including wide-angle capabilities for projection from a minimum "throw-distance."

The system's versatility permits application to console display as well as large screen auditorium or briefing vertical displays. The unit can be packaged to fit under a working table to give a very bright contrast display on a surface that will accommodate cutouts, models and grease-pencil situation logging. Ordinary room lights can be used for working illumination.

FILM STRUCTURE

Continued from Page 5

to obtain a coating of emulsion of uniform thickness, therefore, a special type of clear gelatine having both "water-loving" (hydrophilic) and "water-dreading" (hydrophobic) properties is chosen for the all-important sublayer.

Base Material Important

What about the plastic film-base material, itself? A gelatine film, alone, would be too fragile and dimensionally unstable to serve as a motion-picture film. A relatively tough transparent support material must be used to give the film the necessary strength and rigidity. As a matter of fact, the qualities of the base are largely responsible for the working and handling properties of all the different available types of motion-picture film. When the projectionist blames a specific kind of film for poor splicing characteristics, excessive buckling, rapid wear of the perforations, etc., he usually (and rightly) blames the base material.

Two broad categories of film base, nitrate and safety, have been known since the early days of the art, but the chemical nature of safety base has been changed repeatedly to improve its working qualities and to make it comparable to nitrate base in strength, toughness, rigidity, flexibility, and resistance to the wear and tear of repeated projections. Even though it was preferred for half a century for professional motion-picture film because of its unequalled physical properties, nitrate base is dangerously inflammable - - - almost explosive — and liable to excessive shrinking and to spontaneous deterioration with the passage of time.

First Use of Nitrate Film

Nitrate base is a form of cellulose nitrate made by treating cotton or paper with strong nitric and sulfuric acids. The pure cellulose nitrate, called *collodion,* is subsequently dissolved in a solvent (acetone or a cheap mixture of alcohol, ether, and banana oil) containing "plasticizers" (camphor and tricresyl phosphate) to increase the toughness and pliancy of the material as well as to reduce the tendency to shrink and become brittle.

The common name of the completed base material is *celluloid,* first manufactured by John Wesley Hyatt in 1872. The first celluloid photographic film was produced in 1887 by Hannibal Williston Goodwin of Newark, N. J., who received an order dated September 2, 1889 from Edison for one roll of such film at $2.50. A year earlier, however, Edison had obtained nitrate film from George Eastman, who must be regarded as the first manufacturer of a satisfactory nitrate film stock.

Early Acetate Made in Germany

Safety motion-picture film is very nearly as old as nitrate stock, but until the late 1940's it was largely confined to amateur and other non-professional applications. The old-type cellulose diacetate safety base was first made on a large scale in 1908 by the German chemical firm of Bayer (the originator of aspirin). This base material is made by substituting acetic acid (or acetic anhydride) for the nitric acid of the usual celluloid-manufacturing process; and in order to make the safety film soluable in acetone and other common film-cementing solvents, the degree of acetylation was purposely limited by hydrolysis.

Aspirin and diacetate film base were an appropriate combination, for the costliness, low tensile strength, shrinkage, and excessive brittleness of the old-type safety film were productive of headaches aplenty. The professional motion-picture field had no choice but to reject diacetate film from the outset, and in spite of widespread dissatisfaction with the dangers of nitrate film.

By using other organic acids in conjunction with acetic acid, a number of "mixed-ester" celluloses have been obtained and used as film base. The best known are cellulose acetobutyrate and acetopropionate, the latter having constituted the safety film of Eastman Kodak manufacture from 1937 to 1948. Although somewhat more satisfactory than diacetate base, acetopropionate film lacked the strength and durabiity to replace

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Biography:
Richard F. Walsh

Richard F. Walsh was born in Brooklyn, New York, on Feb. 20, 1900, and educated in the public schools of that city.

He entered the entertainment industry as an apprentice electrician at Brooklyn's Fifth Avenue Theatre in 1917. Three years later, after spending two as an Electrician 3rd Class in the U.S. Navy during World War I, he received his full journeyman's card in IATSE Stage Employes Local No. 4 of Brooklyn.

Mr. Walsh was elected president of that local in 1924 and business agent in 1926. He served in this capacity until 1937. Two years later, he was again elected president and held that post until 1959.

In 1934, Mr. Walsh was elected a vice president of the Alliance. He was chosen international president in 1941 and since then has been reelected at each biennial convention.

Under his administration, the Alliance has considerably expanded its organization of the crafts of stage and screen and in the new field of television. The wage level of the members has steadily increased and is today rated among the highest. Labor stoppages by IATSE locals have been few and scattered. Communist efforts to dominate the entertainment-industry unions have been vigorously opposed. This opposition reached a climax in Hollywood, where the IA was the first to recognize the seriousness of the Red menace and spearheaded a successful drive to stamp it out immediately after World War II.

Mr. Walsh has long been a member of the board of directors of the Union Labor Life Insurance Co. In recent years, he has become very active as a leader of the labor movement as a whole. Beginning with the formation of Labor's League for Political Education, he served on its administrative committee. Prior to the merger of the American Federation of Labor and the then Congress of Industrial Organizations, he was elected a vice-president of the AFL Union Label and Service Trades Department. In 1948, he represented the AFL as Fraternal Delegate at the convention of the Trades and Labor Congress of Canada, and in 1952 he attended the convention of the British Trade Union Congress in the same capacity. At the first constitutional convention of the combined AFL-CIO in 1955, he was elected to its executive council and appointed to its permanent committees on civil rights and international affairs. Subsequently, in 1957, he was a delegate to the Fifth World Congress of the International Confederation of Free Trade Unions in Tunis, Tunisia.

On appointment by President Truman in 1950, Mr. Walsh served as an advisor to the U.S. delegation to the Fifth General Conference of UNESCO in Florence, Italy.

He is chairman of the Will Rogers Memorial Hospital at Saranac Lake, New York, and a member of the executive committee of the amusement division of the National Conference of Christians and Jews. That division presented him in 1952 with the first Brotherhood Award ever received by a labor leader. In 1955, the New York Variety Club presented him with its second annual Heart Award—in recognition of his service as a director of its foundation to combat epilepsy.

One-Man Booth Survey

A survey on one-man booth operations has been started by the Theatre Owners of America in the belief "that statistics on how widespread the one-man booths are and the formulas theatres have used to reduce booths from two to one-man would be of great interest to theatre men." TOA adds that "an increasing number of theatres have been able to secure one man booth operations in their theatres, thereby substantially reducing payroll costs and placing their theatres in a better position economically."

Multi - Overlay Slide Projection Available

Tweedy Transparencies of Newark, N. J. has opened a new era in science instruction with the introduction of a complete science program on 8 in. by 10 in. color slides with multi-overlays. Step-by-step build-up of charts, diagrams and pictures can be accomplished.

The series employing transparencies and sequence overlays, has been created in a way that simplifies concise teaching and testing of even the most complex and detailed subject matter.

Complete information and a listing of titles is available from Tweedy Transparencies, 321 Central Avenue, Newark, New Jersey.

KODAK RECEPTION CENTER AIMS AT TOP EFFICIENCY

ROCHESTER, N. Y. — A two-story reception center, fully equipped with audio-visual features that permit use of the most modern presentation methods, was opened by Eastman Kodak Co. here recently.

Its features include: a sound center with master control of microphones, stereo tape recorders, and amplifiers; a special committee room equipped to include a presentation center and built-in outlets for electronic flash; a 25-seat theater with many unusual facilities; varied assembly rooms with movable walls and additional presentation centers; and a display room with a unique combination of lighting units.

Generally designed to serve as a model of conference rooms where groups and committees can utilize modern presentation methods, the reception center can also be a display center for effective showing of company products.

The first-floor theater seats 25 in four tiered rows. Curved walls and celings and a slanting rear wall are expected to contribute to ideal acoustic conditions.

The large projection screen, of lenticular fabric permits side-by-side projection of three standard images of standard brightness even from 8-mm equipment.

Two speakers that will reproduce either monophonic or stereophonic sound, adjoin the screen. Lines running to the front of the theater will permit any of Kodak's equipment for sound reproduction to be demonstrated with its own speaker.

The master sound center contains stereo tape recorder equipment with associated amplifiers. A master stereo-monophonic control center feeds power amplifiers that drive the speakers. Connections with the second floor make it possible to feed special sound from this area to any room in the meeting complex.

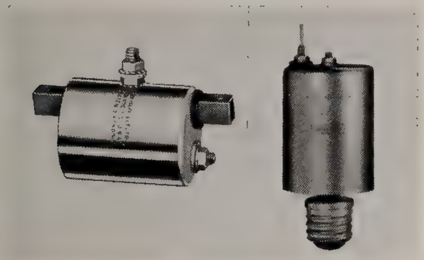
To provide a center for the projection and sound equipment, a moveable stand has been designed to accommodate simultaneously motion picture projectors, slide projectors, and sound equipment that will reproduce disc recordings or tape recordings. With cable connections, the room is provided with a completely automated system that gives the speaker at the lectern full control of all equipment in the projection center.

Kneisley Announces New Rectifier Line

The Kneisley Electric Co. of Toledo, Ohio has announced a complete new line of Silicon Rectifiers for Theatre arcs.

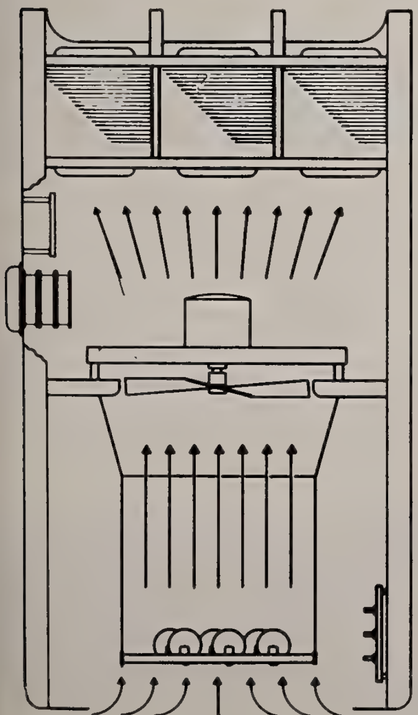
Eight new models range from 40 amperes at 28 volts to 180 amperes at 70 volts in three phase designs, and from 40 amperes at 28 volts to 135 amperes at 65 volts in single phase designs. These designs are unique in that they depart completely from the conventional selenium or silicon rectifier stack designs.

The single and three phase designs up to 80 amperes at 45 volts, for coaxial trim arcs employ copper-enclosed SIL-TUBES, as pic-



tured which are convection cooled, 97 per cent to 98 per cent efficient, hermetically sealed, and non-aging.

All single and three phase units from 100 amperes through 180 amperes, 55 to 70 volts, employ SIL-CANS. The silicon diodes are individually contained in a drawn copper cylinder, closed at both ends, which acts as a heat radiator. Air is drawn over the Sil-Cans as shown in the line drawing, at high velocity, for cooling purposes.



These designs are the result of field requests from heads of projection departments who want the diodes easily accessible and individually replaceable, rather than replace an entire stack. A SIL-TUBE or SIL-CAN can be replaced in about 90 seconds. Both designs result in a substantial reduction of stack replacement costs. Overall efficiencies of the single phase designs run approximately 74—78 per cent; three phase 85—86 per cent.

Salzman Honored

Sam Salzman, member of New York Stage Employes Local No. 1, has received one of the annually presented Roosevelt Awards given by Nassau Suffolk Hospital Council. He was nominated by Saint Charles Hospital, Port Jefferson, Long Island, which gave the following citation:

"For almost 50 years, a unique bond of affection has been formed between Mr. Sam Salzman and the children and Sisters of St. Charles Hospital . . . In the days when Long Island roads were barely passable, Sam Salzman would make the three and one-half hour auto trip out from New York City to bring his films and friends from the show-world of Broadway to the children. As a stage electrician for the New York Theatres, he was St. Charles' official ambassador. The motion pictures taken by Sam Salzman of the first children arriving at St. Charles Hospital were shown in parish halls and auditoriums throughout Brooklyn and New York in the days before "talkies." These movies introduced the hospital and the work of the Daughters of Wisdom to thousands in and out of the theatre industry. The generous public response to the appeals of St. Charles Hospital over the years can certainly be attributed in great part to Mr. Salzman's graphic portrayals of these children and their handicaps in life.

FILM STRUCTURE

Continued from Page 16

dangerous nitrate film in the professional field.

Triacetate Safety the Best

The big break-through in safety film was the discovery of German scientists that a cellulose somewhat more highly acetylated than the diacetate* furnishes a material for film base which more nearly resembles nitrate base in working properties while retaining the advantage of non-inflammability. This is the so-called triacetate* base which is now universally used for theatre-release prints, but first manufactured as early as 1939 by the German photographic firm of Agfa. Production of triacetate film was curtailed during World War II, but was resumed in 1948 when Eastman Kodak led the way by adopting it as a replacement for nitrate, the manufacture of which was totally discontinued in 1950.

All of the professional 35-mm negative and positive film stock regularly supplied to the industry in both Europe and America is now made on triacetate safety base. Representative are the acetate film stocks manufactured by Agfa (Leverkusen), Agfa (Wolfen), Ansco, DuPont, Eastman Kodak, Ferrania, Gevaert, Hauff, Ilford, Kodak Ltd. (London), Kodak Pathe, Lainer & Hrdliczka, Mimosa, and Perutz.

In general, triacetate film is almost as good for projection purposes as nitrate; and, of course, it possesses the supreme advantage of being completely safe under all conditions of use and handling. Acetate film burns much less readily than paper or wood, and it will not support combustion at all when wound up in a roll: it is, in fact, completely devoid of fire danger.

Triacetate film is superior to nitrate in at least a few other ways, e.g. it does not decompose on long-term storage, and it shrinks a bit less than nitrate with age. Modern triacetate film is almost (but not quite) as strong as nitrate film, and it is almost (but not quite) as long-wearing in use.

Triacetate is undeniably a big improvement over diacetate and acetopropionate in regard to brittleness, but even though initially very pliant, repeated projections cause it to become more brittle than nitrate film. This has been as much of a nuisance with TV stations using 16-mm film as with theatres using standard-gauge prints. The tear strength of brittle triacetate film still in usable condition is scarcely 30 to 40 grams, whereas that of fresh triacetate stock of the same thickness (approximately 5½ mils) is close to 60 g (ASTM method D689-42T at 45 per cent relative humidity).

Also, triacetate film is a trifle more liable than nitrate to permanent deformation by mechanical stress when it is heated, as by the arc-lamp beam at the aperture of a projector. Nitrate film also softens when heated, but instead of softening at relatively low temperatures (viz. 200 degree F, the soft-base), it retains a fair degree of rigidity until the tempeature approaches close to 300 degree F, which is high enough to be dangerous in the case of old nitrate prints.

Softening of triacetate film makes it more liable to become permanently buckled by projection with powerful arc lamps, and it becomes increasingly brittle each time it is heated and cooled.**

Even though nitrate film is no longer manufactured, and is prohibited by law in most European countries it is useless to deny the fact that the desirable projection qualities of fresh nitrate stock are still the ideal toward which improvements in acetate film are aimed.

Film-Shrinkage Problem

When it comes to old, well-seasoned prints, acetate films give better screen results than nitrate films which have also been much used. This is because well-worn nitrate film shrinks and deteriorates physically more than acetate does.

The greatest amount of linear shrinkage of nitrate film seen by the writer was 1.7 per cent in some used theatre prints made during World War I. Film as shrunken as this really "sings" on the sprockets, making such loud buzzing and crackling noises that the projectionist may fear imminent breakage. Careful control of the nitration process and the use of superior plasticizers resulted, in later years, in nitrate positive stock which shrank only about 0.30 per cent after a 2-year storage period under ideal conditions, or 0.60 per cent after 2 years of wear and tear in the theatres.

The frequently repeated statement that triacetate film is practically immune from shrinkage is, of course, completely untrue. It shrinks less than nitrate; but the usual triacetate base formulated for theatre-release positive *does* shrink appreciably, and it becomes more brittle than nitrate.

Tests on different brands of triacetate projection film reveal that this type of film shrinks 0.25 per cent after 2 years of storage, and about 0.40 per cent after 2 years of heavy projection duty in theatres. In other words, triacetate shrinks about 80 per cent as much as nitrate after 2 years of storage, or 65 per cent as much after a like period of normal projection use. It must be kept in mind, however, that different samples of different brands of film show a wide variance in the rate of shrinkage.

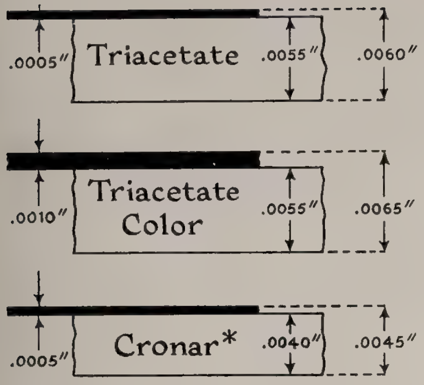
A special triacetate base has been formulated for motion-picture negative which shrinks up to 0.18 per cent after 2 years of storage, and never seems to exceed the low shrinkage of 0.20 per cent no matter how long it is stored! This type of base is unfit for projection purposes, however, because the heat of the arc lamp expels the plasticizers and causes it to become excessively brittle.

"Pitch" of Sprocket Teeth

The shrinkage of release- positive stock it an important factor in the design of projector sprockets, especially the intermittent sprocket. The perforations of freshly made 35-mm positive raw stock are spaced 0.187 inch from the edge of one sprocket hole to the

*A 10-octave frequency range means that the lowest frequency is doubled, the resulting product likewise doubled, etc., for a total of 10 times. The mathematical formula is **a** equals 512**b**, in which **a** is the high-frequency limit and **b** is the low-frequency limit.

***The Greek letter π ("pi") represents a definite transcendental number which cannot be exactly expressed as a rational integer. Approximately equal to 3.1416, it is the ratio of the circumference of a circle to its diameter. Its reciprocal ($1/\pi$) equals 0.3183, approximately. See Chapter 30 of **Mitchell's Manual of Practical Projection** for an easy-to-understand explanation of a few common mathematical terms with which the projectionist should be familiar.



*DuPont product

Fig. 2—Thickness of various types of film base and emulsion. Technithickness as black-and-white emulsion, color film has an emulsion the same but that of dye-coupler color film is twice as thick. The old nitrate base (not shown) had a thickness of 0.0050 inch, making it a trifle thinner than modern triacetate base. DuPont Cronar base is the thisnest of all.

corresponding edge of the adjoining one. This is the "pitch" of the perforations.

To fit fresh film exactly, therefore, a 16-tooth intermittent sprocket must have a diameter of: $0.187 \times 16 \times 1/\pi$ - 0.952 inch. ***

This is rather larger than the standard 16-tooth intermittent sprocket, which had a diameter of 0.935" in the days of badly shrunken nitrate film, and variously 0.940", 0.943", 0.945", and 0.950" since the advent of triacetate safety film. These sprockets provide a perfect mesh with the perforations of 35-mm film having the following amounts of shrinkage:

Sprocket Diameter	Tooth Pitch	Per Cent Film Shrinkage
0.935	0.1836	1.82
0.940	0.1846	1.28
0.943	0.1852	0.96
0.945	0.1856	0.75
0.950	0.1865	0.27

Inspection of the above data reveals that a sprocket designed to accommodate film which has shrunk 0.40 per cent (triacetate after 2 years of projection use) should have a diameter between 0.945" and 0.950", namely, 0.9485" with a tooth-pitch of 0.1863". Such sprocket (like other large-diameter sprockets) is noisy with excessively shrunken films, but tests have proved conclusively that the largest practicable intermittent sprockets greatly extend the life of the prints.

Cronar Film Ideal?

The ideal projection film should have great strength, rigidity, flexibility, and not shrink or get brittle at all. These requirements are met almost perfectly by a base material made from a polymerized reaction product involving dimethyl terephthalate and ethylene glycol, and known as "polyester base" or by the DuPont trade-name "Cronar."

But unfortunately for the application of Cronar to the production of theatre-release prints, films made of this amazing material cannot be spliced in the usual way with solvent liquids (there are no common, safe ones for Cronar), and it is *too strong* for the projectionist's peace of mind.

Cronar film is so strong that it is difficult to tear it with the fingers; and once a tear has been started, continued tearing demonstrates that it is considerably tougher than either nitrate or acetate. Experience has shown that a jam-up with Cronar film either stalls the projector with disconcerting suddenness or strips the gears. Cronar prints are thus dangerous to 35-mm theatre projectors.

These two drawbacks of Cronar are extremely regrettable, for even under the most unfavorable conditions, Cronar gets tougher with age and shrinks only 0.05 per cent. It is rigid and flexible, and so strong that it shows no perforation damage even when run 10 times more than the number of times which makes a total wreck of nitrate or acetate! What a pity that Cronar cannot be spriced except with adhesive tape or expensive dielectric splicing machines!

Taped Splices Condemned

The permissibility of splicing amateur 16-mm films with Mylar tape has occasionally been mentioned in IP — a method which could appeal only to the "sloppiest" film worker, — but, as on other past occasions, we condemn the use of Mylar and similar adhesive tapes for splicing 35-mm theatre-release films. Taped splices are messy, often fail to run smoothly, spoil two frames of film, and collect incredible quantities of grime and filth. None but completely worn-out "junk" prints, ready for the scrap-heap, deserve to be afflicted with taped splices.

There are only two acceptable ways of joining professional film: (1) scrape emulsion from the overlap stub and apply film cement, and (2) employ a dielectric film-welding machine.

Another type of polymer film base, called "polycarbonate," shares Cronar's resistance to both

film cements and dimensional change. In some ways polycarbonate resembles acetate. There are no good solvents for Cronar, which is formed into film by extrusion when molten. Polycarbonate, on the other hand, can be dissolved in certain liquids and "cast" in the usual way onto the polished surface of a slowly revolving drum. There is some question as to whether polycarbonate is sufficiently rigid for motion-picture film, and to date it is used chiefly for graphic arts sheet film in applications requiring an extremely thin base and freedom from dimensional change under varying conditions of temperature and humidity.

M.I.T. Physics Expert Demasds More A-V in Science Teaching

Speaking at the White House conference on children and youth, Jerold R. Zacharias, professor of physics at the Massachusetts Institute of Technology, declared that he is ashamed of the educational system that denies participation in science to more than 90 per cent of our citizens.

"Unless professional scientists actually sit down and write our school texts," he said, "We condemn ourselves to the situation that now exists: physics, chemistry, biology, and mathematics (and for all that, geography, history, and economics) as they are taught in the schools bear no relation whatsoever to physics, chemistry, biology, or mathematics as they are practised. They can neither inspire the student nor excite him; they bore and repel him because they are boring and repellent.

"All school science courses should be prepared by first-rate scientists and mathematicians, presented with all the rigor of true scholarship, *and supported by every teaching device our society can bring to bear.*"

The preparatory texts for the White House conference, which began in Washington in March, and is held every ten years, were edited by Eli Ginzberg, professor of economics, Columbia University.

Norelco 70/35 Now On the Market

Neils Tuxen of North American Philips Co. and George P. Skouras have announced that Norelco Universal 70/35 equipment, previously handled exclusively by the Todd AO Corp. George P. Skouras interests, has now been placed on the open market, to be made available to exhibitors by theatre supply dealers throughout the States, including National Theatre Supply.

In addition to the Norelco 70/35 mm projectors, the complete line of Philips projection equipment will also be made available. This line includes the FP 7-35mm projector and the new FP 20-S "shutterless" 35 mm projector with pulsed gas discharge light source, as well as portable 35mm and 16mm professional projectors.

BUILT-IN VIEWER FEATURE OF NEW PROJECTION UNIT

St. Louis—An 8mm projector that shows movies on its own built-in viewer as well as on a conventional projection screen was introduced by the Kalart Co. at the 36th Annual Convention of the Master Photo Dealers' and Finishers' Assn. in St. Louis.

The new product, the Kalart VP-88, is actually a two-purpose utility in one compact piece is said to be the first popularly priced product in the 8mm field to combine the features of a motorized action editor with an easy-to-operate projector.

It utilizes the same optical system, film transport mechanism and controls for projecting film on the screen of it's built-in viewer. Set-up is fast, film is guided by nylon rollers, and the main control lever issused for forward and reverse when projecting on screen, and forward, reverse and still when projecting on it's built-in viewer.

The new projector is said to offer magnificent picture quality and flicker-free action. Projection lens is F:1.4, 17mm; lamp is Sylvania DCA Tru Flector 150 watt with 500 watt screening efficiency. The built-in viewing screen — a full $2\frac{1}{4}$ x $3\frac{1}{8}$ — permits both table-top viewing and editing. Families can preview their movies without setting up a screen or darkening the room.

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VOLUME 35 NUMBER 8

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EAST COAST OFFICE
545 Fifth Avenue
New York 17, N.Y.
Murray Hill 7-7746

RAY GALLO
General Manager

MIDWEST OFFICE
4616 Washburn Avenue South
Minneapolis 10 Minnesota

FRANK W. COOLEY, JR.
Editor and Publisher

R. ENTRACHT
Associate Publisher

RAY GALLO
General Manager

R. A. MITCHELL
Technical Editor

In This Issue . . .

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MONTHLY CHAT

SCREEN ADVERTISING A DANGEROUS IRRITANT

LET'S TAKE A LOOK at our sister audiovisual medium, TV, for just a moment. Being firmly rooted in the theory that the airwaves are free only to those who can afford program sponsorship, American television lies flat on its back under the anesthetic spell of Madison Avenue commercialism. As a result, free TV has been robbed of imaginative entertainment programming. After years and years of the loud and frequent "pitch"—a horror that Europeans have to see and hear for themselves to believe—the public is beginning to rebel.

In what way? Simply by demanding to be allowed to pay for quality entertainment of its choice. So, brother, don't underestimate the power of the sleeping giant—"pay-TV!"

The facts are indisputable: ninety or more per cent of all "audiovisual" advertising is blatant, tawdry, inane, misleading, and much too frequent. We simply cannot trot out to the icebox for another bottle of beer that often! Yes, the TV-viewing public is tired of "important messages" which seem intent upon blasting the brains of their captive audience into a jelly of mesmerized idiocy.

We are grateful for the notable exceptions, but they are much too rare.

Because the public is willing to pay for entertainment it cannot find on the home TV screen, it is also regaining the movie habit. But what if the giant theatre screen, wide open to the covetous eyes of scheming hucksters, should become a giant advertising medium and betray the patrons who have bought tickets to be entertained, not barraged by commercials?

What a fertile field to smear with frenetic commercial garbage in behalf of cigarettes, beer, automobiles, diapers, washing powders, deodorants, toothpaste, pills, salves, and drops for ingrown toenails! Can you envision a 30-foot toe on a 60-foot screen? Living girdles will dance with ecstatic vitality in full color and CinemaScope!

"God forbid!" you say? Well, it's too late! The dirty work has begun. The fact that the captive movie audience paid good money for entertainment and relaxation out of earshot of the loud-mouthed blabber and coy baby-talk of TV's super-duper salesmen is blithely disregarded. The paying customers, irritated by commercials they are forced to watch and disgusted by the knowledge that their patronage is being prostituted, may soon stay away from theatres in droves. Can you blame them?

In the years before TV it was accepted practice in the smaller theatres to screen a short reel of paid advertising trailers. The local ice-cream parlor, the bank, the drugstore, and the village undertaker were each announced on the screen via an animated title appended to a ready-made "playlet" farmed out by commercial producers of that sort of hokum.

As long as these screen ads were kept brief and in good taste (a rare commodity since TV), there was no openly voiced objection. These little dabs of celluloid imbecility never increased business for any advertiser, but they fostered a community spirit and offered visual evidence that the neighborhood cinema was a community institution.

These gentle traditions have now been buried beyond recall by the high blood-pressure specialists of New York, Chicago, and Los Angeles. Audiovisual commercialism

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INTERNATIONAL PROJECTIONIST

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IATSE 45th Convention Faces Up to Projectionists' Problems

CHICAGO—New methods of projection and new electronic devices which the members of the International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators of the U.S. and Canada will be called upon to operate are good cause for optimism, according to Richard F. Walsh, president of IA, speaking at the 45th convention of the Alliance here recently.

Both the American economy and the need for entertainment are expanding, the IA president observed, backing up the feeling of optimism and emphasizing that there has been "a distinct upsurge of movie attendance throughout the United States, accompanied by a wave of optimism for the future."

The U.S. Department of Commerce, the president said, reported that box-office receipts rose by 7% last year on top of a 4.3% rise the year before. This followed construction in 1958 of 48 new drive-in theatres and 22 new hard-tops and the reopening of 554 houses which previously had been closed. 1959 saw a total of 68 more new drive-ins and 35 more new hard-tops plus 353 reopenings.

President Walsh noted that the situation in Canada is different, with receipts down somewhat probably because television came later to Canada.

"I think, however," President Walsh said, "we can reasonably assume that the Canadian experience will be similar to what has happened here. The novelty of TV will wear off and the basic health of the theatrical film industry will be demonstrated."

Number of Theatres Climbing

While the number of theatres in existence now is slowly climbing, the president reported, there has been a drastic reduction since the industry's best days. The present theatre count is approximately 16,000 compared with 18,500 in 1954.

"Although this decline has naturally reduced the number of available jobs, most locals have avoided unemployment problems by not replacing members who died or retired in recent years, and some locals actually face manpower shortage — at least during the vacation period, which is also the busy drive-in season.

"Indications are that there will be a more serious shortage as time goes on unless we take careful steps to recruit and train competent projectionists."

IA member Merle Chamberlin of Metro-Goldwyn-Mayer called the two years since the 44th convention "technologically unspectacular." The speaker mentioned that this was a good thing, because even though the industry had not had any revolutionary processes or innovations introduced either in the production or re-production end of the industry, it may have been just as well since it gave all projectionists an opportunity to analyze the compartively large number of technical innovations "thrown at us the previous few years."

Mr. Chamberlin said this circumstance enabled the industry to retain processes or mediums which had proven to be of practical value. In his opinion, the industry is pretty well down to one type of wide screen and two large film processes: the Todd-AO,

PROJECTIONISTS CONFER — During the convention of the IATSE in Chicago recently, projectionists locals gathered; at the left above members of the Iowa delegation read IP, and at the right Patricia Coyle of the Chicago garment workers local presents union label promotional material to Nile C. Canady, Capitol Theatre, Wheeling, W. Va., Local 64, and William H. Nestor, Fairmont (W. Va.) Theatre, Local O 239.

which he termed the straight process, and the Metro-Goldwyn-Mayer Camera 65, which is the partial anamorphic process in wide film.

Stereophonic Sound Comeback

"We have witnessed quite a surge of stereophonic sound," Mr. Chamberlin said. "It faded a little but it is coming back fast. Properly recorded, properly reproduced on good equipment, I do not think anything can beat magnetic stereophonic sound." In many cases the boxoffice has backed up that opinion, Mr. Chamberlin said.

The speaker passed on to the membership the experimentation involved in the adjustment of the speakers used in stereophonic optical sound, using the subsonic record on the control track to switch the sound from speaker to speaker. Referring to the considerable trouble in the past about directional sound and surround speakers, he called attention to the simple cure of turning the surround speakers upside down to point them to the ceiling, letting the surround sound work off the ceiling for "perfect distribution. There is no concentration or directional effect and stereophonic sound begins to sound like it should."

Standardization in many things, specifically the aspect ratio, was termed fortunate by Mr. Chamberlin:

Standardization Helps All

"This standardization has helped all of us," he said, "especially you members working in the theatres. It has helped us to concentrate on the best presentation possible with the equipment and the mediums that we have at hand instead of worrying about whether or not whatever we are working with is going to be with us by next Monday.

"By technologically profitable I mean the steady improvement of the newer equipment and mediums. Our studio technical staffs are continually striving to produce a superior visual and audio basic product. Our equipment manufacturers are continually developing and offering accessories and modifications to existing equipment to help us improve our reproduction. And most important, it is recognized that the members of IA in the field are diligently and tirelessly striving to improve their knowledge of the various phases of reproduction, which enables them to put on the finest show consistent with the age and condition of equipment furnished in the many projection booths around the country."

Mr. Chamberlin termed of major importance, as far as recent improvements are concerned, better projection lenses, the all transistor projection amplification system which promises to be much quieter and more trouble free, improved projection lamps and improved carbons to go with them, plus more improved carbons to increase the efficiency of older lamps and substantial progress toward the practical solution for an "all purpose" print.

Resolutions Reviewed

One of the most important resolutions acted upon by the International Alliance during the Chicago meeting was one in which the convention was asked to "voice its unalterable opposition to the making of films in foreign countries by American producers for the American market, and asking that IA exercise its power and influence to counteract and minimize such practices, as well as advising the American producers of these foreign films that members of IA will boycott all pictures made outside the continental United States not carrying the seal of IA.

They also resolved that the IA should go on record before Congress that an American citizen who resides outside of the United States shall be entitled to no tax exemptions until such a person or company has been a non-resident of the United States for at least ten years, in line with the feel-

(Continued on Page 20)

Richard F. Walsh of IATSE Named Will Rogers Hospital Board Chairman

NEW YORK—Richard F. Walsh, recently re-elected president of the IATSE, is the new chairman of the board of the Will Rogers Memorial Hospital. He succeeds the late Robert J. O'Donnell.

He has been an ardent supporter of the institution for years and a number of members of his union have been treated there.

Announcement that Walsh had been nominated for the presidency was made at the annual luncheon which followed an inspection of the hospital June 23. All members of the board were re-elected.

Walsh

Abe Montague, executive vice president of Columbia Pictures, presided. One of the features of the luncheon was the presentation of a golden statuette of Will Rogers to Harold Keeter of the United Artists Exchange, Charlotte, N.C., as the man-of-the-year. With the help of the distributors and exhibitors committee in that area he introduced "the most extraordinary innovation of the campaign. The Charlotte group held 221 special benefit shows, took up audience collections in addition, and made a success of the Christmas Salute. As a result, the total returns from the Charlotte area were five times greater than the previous year.

The directors hope this system of raising funds will spread to other exchange areas this year.

Ned E. Depinet paid a fervent tribute to Bob O'Donnell in which he said: "It is not surprising that the true friendship which he expressed and lived permeated every purpose and policy of the Will Rogers Hospital, and every individual participating in any way in its operation."

During the past year 43 patients—mostly arrested cases—were discharged. The medical and nursing staff is fully complete for the first time. General repairs and repainting have been extensive. The average time for the stay of patients has been reduced to 228 days.

Walsh Again Heads IA; All Officers Re-elected

CHICAGO—All officers of the IATSE were re-elected for a 2-year term. They are:

Richard F. Walsh, International President; Harland Holmden, General Secretary-Treasurer; Walter F. Diehl, Assistant International President; James J. Brennan, First vice-president, Ramsey, N.J.

Carl G. Cooper, second vice-president, Los Angeles; Harry J. Abbott, third vice-president, Philadelphia; Orin M. Jacobson, fourth vice-president, Tacoma, Wash.; Hugh J. Sedgwick, fifth vice-president, Hamilton, Ontario, Canada; Albert S. Johnstone, sixth vice-president, New Orleans; John A. Shuff, seventh vice-president, Akron, Ohio; LeRoy Upton, eighth vice-president, St. Louis, Mo., and Jerry Tomasetti, ninth vice-president, Brooklyn, N.Y.

Trustees are: William C. Scanlan, Lynn, Mass; R. E. Morris, Mobile, Ala., and George W. Brayfield, Golden, Colo.

THE DESIGN OF SHUTTERS FOR MODERN PROJECTION

By Robert A. Mitchell, Technical Editor

THE DESIGNING of an efficient projector shutter is a tough job. By comparison, the designing of a camera shutter is very easy. A movie-camera shutter has only to open once for each frame of film to be exposed (24 each second); and the ratio of open to closed periods of the shutter cycle is not critical. Accordingly, rather slow-acting, but quiet and mechanically simple, claw movements can be used even in professional studio cameras. A claw movement for even a 16-mm projector must be relatively fast-acting; and claw movements of this type are noisy. The reason for the difference in camera and projector intermittents is to be found in the different requirements of camera and projector shutters.

The shutter of a projection machine has much more to do than expose one frame of film at a time on the screen. It must cut off the projection illumination more frequently than 24 times a second in order to avoid violent flickering of the picture.

Thus, in addition to cutting off the light while the intermittent pulls the film down another frame, the shutter must also produce another cutoff of equal duration right in the middle of the dwell period when the film is "at rest!" This expedient raises the cutoff frequency to 48 cycles per second, which is fairly satisfactory even though most projection engineers feel that the shutter frequency should be higher than this to avoid flicker in the brightest highlights of the pictures—clouds, snow, white buildings, etc. Run a projector without film in it, and you will see for yourself how very perceptibly the blank field of white light on the screen flickers.

By utilizing 3 cutoffs per frame of film—two of them in the dwell period, — the shutter frequency is increased to 72 "flashes" per second, and no flicker is visible no matter how bright the picture. Unfortunately, ordinary theatre projectors having 3-to-1 geneva intermittents cannot use 3-wing shutters without producing the flickering vertical streaks of light known as "travel ghost" in the pictures. Travel ghost is caused by exposure of the film while it is moving at the aperture. Although 5-to-1 "accelerated" intermittent movements are available for at least one modern theatre projector, few theatres have them, and those that do employ narrow-blade 2-wing shutters for greater screen illumination.

Speaking frankly, there is a peculiar film-buckling problem attendant upon the use of 3-bladed rear shutters. These shutters were nevertheless very popular in the days of the old 5-to-1 Powers pin-cross intermittent; but in the Powers the shutter was positioned in front of the projection lens, not between the aperture and the arclamp. Because 5-to-1 intermittents and 3-wing shutters have been discussed in IP many times, this article is confined to shutters for use with conventional 3-to-1 movements.

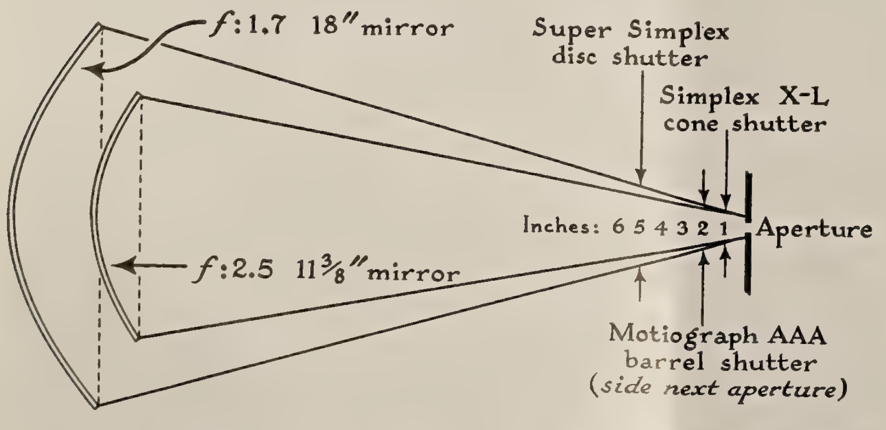

FIG. 1—This diagram, drawn to scale, shows the difference in the widths of the light beams produced by large-mirror f/1.7 and small-mirror f/2.5 arclamps. Indicated in the drawing are the points where various types of shutters cut the light beam—the closer to the aperture, the more efficient the shutter action.

90 Degrees Minimum Blade Width

A conventional shutter is required only to cut off the light during the intermittent pulldown period (1/96 of a second at standard film speed), and also to provide a "balancing cutoff" of equal duration in the middle of the dwell period to give a 48-cycle exposure frequency. (Keep in mind that the balancing cutoff must be **exactly** as long as the pulldown cutoff, else annoying 24-cycle flicker will appear. The two blades must therefore be of **exactly** the same angular width.)

On the basis of these unavoidable requirements, each of the two blades of a disc-type shutter must be at least 90 degrees in angular width — the width that covers any point in the projector light beam for 1/96 of second, which equals one-fourth of the total 1/24-second frame frequency. Such a "maximum-transmission" shutter has a light transmission of 50 per cent.

Now, if the shutter blades be narrower than 90 degrees, the light will be cut off for less than 1/96 second during the film pulldown, and flickering streakes of travel ghost will radiate vertically from the top and bottom edges of all bright areas in the projected pictures.

In actual practice, however, the blades of a disc shutter must be a trifle wider than 90 degrees. Why? The cutoff action is far from being instantaneous. The blades usually intersect the arclamp beam at at a point where it is several inches wide; and an appreciable interval of time is required for the edge of the shutter blade to pass through the beam to compete the cutoff action. A theoretically **perfect** shutter would open and close the light path **instantly,** but no real shutter is quite as efficient as this.

Fortunately, it is also true that the film starts and stops so very gradually when a geneva intermittent movement is used, that a little "cheating" in the width of the shutter blades is permissible. In other words, the appearance of the picture may not be harmed (under certain conditions) if the light is cut off by the shutter a movement after the film starts to

move, and opened up again a moment **before** the film comes to rest. But if this so-called "cheating" has been carried too far, and the level of screen illumination is high, the edges of bright objects in the picture will appear to tremble, or flicker. Still further narrowing of the shutter blades will mar the picture with travel ghost.

No Formula for "Cheating"

Exactly how much "cheating" in the width of the shutter blades is allowable: Not very much, actually. If measurements of the light beam at the point of cutoff indicate that a blade width of about 110° is needed, it is possible in some cases to narrow the blades down to about 100° without spoiling the appearance of the picture. If this can be done without ill effect, the picture will be about 14% brighter—a worthwhile light gain.

Drive-in theatres with their large, light-poor screens tolerate narrower shutter blades than do indoor theatres having brilliantly lighted screens. Even though travel ghost may actually be present on the screen of a drive-in, the low light level keeps it below the threshold of perception. An invisible ghost is, for all intents and purposes, a harmless ghost. But, as a projector manufacturer recently remarked to the writer, the pendulum has swung too far.

"Because travel ghost makes for an unpleasing picture," stated Fred

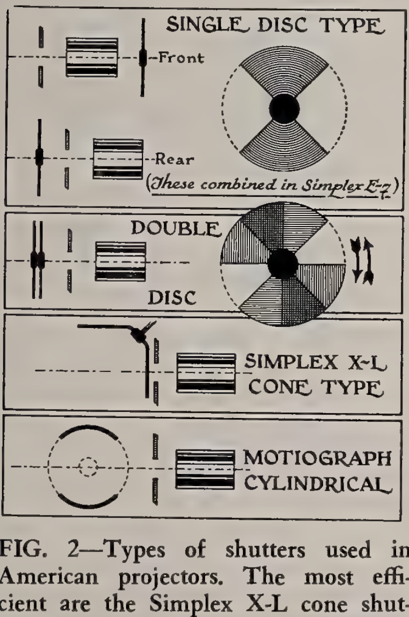

FIG. 2—Types of shutters used in American projectors. The most efficient are the Simplex X-L cone shutter, because of its proximity to the aperture, and the Motiograph barrel shutter, because of its nearness to the aperture and double-cutoff action. Front disc shutters went out of style with silent pictures, and the front-and-rear combinaiton has been abandoned as clumsy.

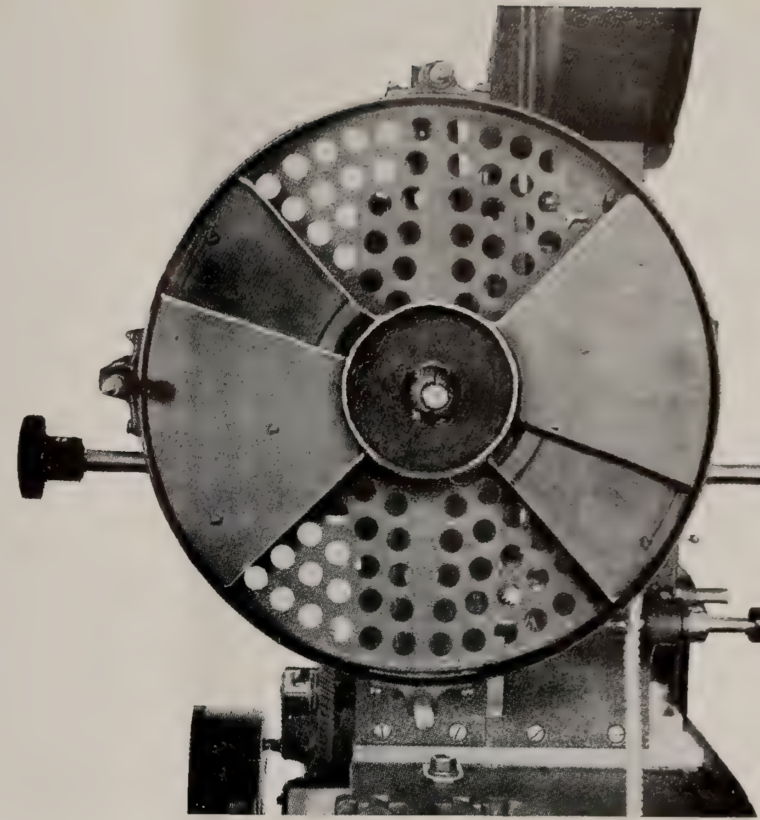

FIG. 3—The Super Simplex rear disc shutter of the adjustable blade type for maximum screen light without travel ghosts. Being positioned 5 inches behind the aperture, this shutter has to cut a light beam too wide for efficient action.

Matthews of Motiograph, "there are, of course, definite limits as to how far the width of the shutter blades can be cut down. Actually, I believe that the demand for more and more light which was brought on by the need to illuminate better the large screens of drive-ins, has resulted in less pleasing picture presentation."

There is no handy formula which will enable you to calculate beforehand how wide your shutter blades should be for the brightest pictures without "edge-flicker" or ghosts. This is a matter that has to be determined by trial and error, inasmuch as three independent factors are involved. These affect blade width as follows:

(1) LIGHT. If the level of illumination on the screen is high, the shutter blades must be wider to avoid ghosts than would be the case if the pictures were dimly lighted.

(2) LAMP OPTICAL SPEED. If the arclamps are "fast" large-mirror models (a low "f-number"), the shutter blades must be wider than would be the case with old-fashioned "slow" lamps.

(3) MECHANISM GEAR-TRAIN BACKLASH. If there be excessive backlash in the shutter driving gears, permitting them to "hunt," the blades must be made wider to prevent the sporadic "flaring-up" of ghosts.

Adjustment of Shutters

A few projectors come equipped with adjustable shutters, while other mechanisms have shutters of fixed blade width. Both types of shutter are available for the Super Simplex and, just recently, for the Simplex X-L (cone-type shutter). The front and rear shutters of the Simplex E-7 are adjustable for coordinated action. The cylindrical shutters of the Motiograph AA and AAA are not adjustable, but four different shutters are available for these machines.

The difference between these Motiograph shutters lies in the width of the blades, which are 2.385", 2.278", 1.937", and 1.170", respectively. The later are wo mainly for drive-in use where a slight amount of travel ghost is not perceptible, whereas the former two are for indoor projection at relatively high light levels.

The projectionist operating on mechanisms having rear disc-type shutters should narrow his shutter blades to the point where ghosts **just barely** become visible on **both** the top and bottom edges of bright objects in the projected pictures, and then widen the blades a trifle to eliminate these ghosts.

This is an easy job if the shutters are of the adjustable type, but certain precautions should be observed, namely:

A-1. First of all, obtain a good "travel-ghost test film" for checking the shutters. The best test film for this purpose is a plain title (sharply

focused white letters on a plain background) spliced to form a loop which can be projected as long as necessary. The title should be focused on the screen as sharply as possible, and the glass removed from the observation ports while the test is being made. If the "throw" is a long one, use binoculars to examine all parts of the image on the screen.

A-2. Remove the rear guard of the shutter case. By means of the shutter timing knob, set the shutter midway to remove all ghosts. Loosen the blade set-screws, narrow the blades a few degrees, and tighten the screws to repeat the screen test. If ghosts appear, reset the shutter in midway position while the title is being projected.

A-3. When the blades are so narrow that ghosts flare from **both** the tops and bottoms of the white letters, widen the blades to the point where they just disappear. **Then widen the blades 3 or 4 degrees more to make sure that backlash in the shutter gear train does not bring the ghosts back to haunt your pictures during a show!** Again reset the shutter in exact midway position with the timing knob, and make double certain that all shutter screws are tight before replacing the rear cover of the shutter case.

A-4. You can also check shutter timing by means of the intermittent sprocket. Place a fixed marker over one (any) tooth of the intermittent sprocket when it is "at rest." Turn the mechanism very slowly by means of the handwheel. When the second tooth from the first comes under the marker (tooth "number 3"), the master blade of the shutter should be in dead center in the optical axis of the light beam—the exact middle of the cutoff.

Fixed-Width Shutter Blades

Projectionists using fixed-width shutters will find shutter trimming a very tricky job. First determine whether or not the shutter blades need any substantial amount of trimming. If they don't, you've saved yourself a real headache.

B-1. This can be done by removing the glass from the observation ports and projecting the loop of title test film described under A-1. Turn the shutter timing knob in each direction to find out how much "leeway" exists between the two points where ghosts appear, first on the tops and then on the bottoms of the projected title letters. If there be little leeway in this respect, the blades of the shutters are already as narrow as they ought to be. But if, on the contrary,

the blades seem to be definitely too wide, proceed as follows:

B-2. Do not trim the blades of fixed-width shutters by guesswork — what would you do if you took off too much with the tinsnips? Unless you have an extra shutter handy, cut a test shutter out of stiff, light-weight sheet iron, and use that for making a pattern for trimming the regular shutters. **(Warning)** Be very sure that the test shutter is flat and does not strike against the shutter case—else mechanism gears will be stripped!)

Setting the Test Blade

B-3. Score or mark the test blade radially (from the exact center of the shutter-shaft hole) when the edges of the regular shutters are radial, as is the case with the Simplex Regular and Super Simplex mechanisms. Score both blades to the same angular width, and double-check the subtended angles by means of a protractor before cutting the blades with tinsnips. This is very important, because a small difference in the widths of the two blades will make the picture flicker.

B-4. When the blades of the trial shutter are just narrow enough to reveal **very slight traces** of "up" and "down" travel ghost than cannot be removed with the timing knob, **score the regular shutters about 5° wider for safety's sake.** Cut very accurately, smooth the edges with a wipe of emery or garnet paper, install in the mechanism, tighten the replaced screws, and "time" either with the timing knob or by the intermittent-sprocket test described in A-4.

Once the blades of a shutter have been properly trimmed for maximum light without ghosts, image tremble, or flicker, there should be no need to alter their width again unless (1) the level of the screen illumination is substantially changed, (2) new arc-lamps having a different optical speed than the old ones are installed, or (3) severe backlash in the shutter develops because of wear of the gears or bearings.

Disc Shutter Least Efficient

There are so many different kinds of shutters, projectionists often ask which is the best type. Actually, there are several good types used in modern projectors; but one type of shutter may be mentioned without hesitation as the **least efficient** of all. This is the single disc, or fan-type, rear shutter of the kind which was first used on the Super Simplex many years ago, and is still the most prevalent type of shutter this side of the Atlantic. Nearly all of the old Simplex Regular mechanisms which have survived from silent-picture days have been "modernized" with rear shutters of this type, and Wenzel, Century, Superior, and Brenkert mechanisms are fitted with no other type, although some models of these projectors are fitted with double shutters for faster cutoff and increased light transmission.

Modern Simplex and Motiograph projectors do not use disc-type shutters. This type of shutter was abandoned many years ago by the manufacturers of these film projectors in favor of more efficient types—shutters which cut the light beam so quickly that the width of their blades can be materially reduced for higher light transmission and brighter, more life-like motion pictures.

Optically Efficient

The old front shutter of the silent-movie era was optically very efficient because it could be postioned in the "aerial image" of the arclamp mirror or condenser a few inches in front of the projection lens. The diameter of the aerial image hardly ever exceeded 1 inch, and is independent of the diameter of the projection lens (although affected by the focal length of the lens — short-focus lenses giving smaller aerial images). But as more powerful arclamps came into use, the shutter had to be moved behind the aperture to reduce overheating of both the film and the mechanism. Low-intensity arcs, be it remembered, were extremely hot for the amount of light they gave.

Rear-Shutter Projectors

Some of the earliest projectors had rear shutters; but the Super Simplex, as we said, was the first American theatre machine to have a really practical one. It could not be as efficient optically as the old front shutter because, being positioned 5 inches from the aperture between the mechanism and the lamp, it was required to cut a light beam approximately 2 3/4 inches in diameter at a lamp speed of f/2.5. 3 in. at f/2.3, 3½ in. at f/2.0 or f/1.9, and 3¾ in. at f/1.7, the last being the average speed of the most modern arclamps.

Forasmuch as the center of the shutter shaft was only 4 inches from the optical axis of the light beam, the cutoff action of the shutter blades was sluggish, which makes this shutter shamefully wasteful of light at lamp speeds faster than the old-fashioned slow speed of f/2.5.

Hold everything, fellows! This is only half of our examination of the shutter problem as it affects projection today. Part II next month.

(To Be Concluded)

Everywhere in the world... because it's on film!

Yes, film is everywhere—everywhere there are people! And because it is everywhere, and so many millions see it, making it right in technic is both a privilege and a responsibility. That, in brief, is the philosophy of the Eastman Technical Service for Motion Picture Film—a service highly regarded by all who call upon it.

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LETTERS TO THE EDITOR

The Best "Accelerated" Intermittent Movements Are Made in the U.S.A.!

Editor, IP:

Please rest assured that I am most grateful to IP for technical assistance previously furnished. Here are three questions concerning rapid-pulldown intermittents which I'd appreciate your answering for me:

1. I am under the impression that the Baird projector (circa 1925) had a 6-to-1 intermittent movement. Can you confirm this, and are there any drawings or patents which would reveal the manner in which Baird accomplished the faster pulldown? If it be true that it was faster (at least 5-to-1), what would be the most practical approach in getting Baird movement into a more modern head, particularly one which would permit the use of front and rear shutters simultaneously, viz. early standard Simplex, Super, or E-7? In other words, does it appear feasible to transfer the entire Baird geneva as a unit to any projector presently equipped with an optically fast shutter by reasonable mechanical modifications, or to remake the present 3-to-1 geneva introducing Baird's principle of faster pulldown?

2. I assume from page 27 of the February 1957 issue of IP, and also from at least one of Robert A. Mitchell's articles, that Radion (France) uses a method of accomplishing a 5-to-1 pulldown ratio, which is an improvement over domestic methods of attaining the 5-to-1 ratio in a geneva. Do you have any drawings which would reveal their method, and if not, may I have the address of the Radion Company?

3. I am in the market for an unlimited number of geneva projectors, portable or otherwise, which have been converted to use the 5-to-1 pin-cross movement successfully. Do you know the whereabouts of any individuals or business firms who have made such conversions, particularly those who have the skill and facilities to make the mechanical alterations?

IP's Technical Editor replies:

1. We haven't heard the old English Baird projector mentioned for a good many years; and while this writer is not sure of the exact pulldown ratios employed in any of the mechanisms manufactured by C. R. Baird from 1914 to 1928, it is certain that they were greater than the conventional 3-to-1. A geneva movement accelerated by levers as in one of the later Edison models was employed; and this was described, with diagrams, by A. C. Schroeder in Part II of his 3-part article, "The Geneva Intermittent Movement" (IP for April 1950, p. 14 et seq.).

I cannot envision anyone's attempting to squeeze this antique movement into a modern head; and there certainly wouldn't be room enough in a neat, compact machine like a Simplex! But why bother with **transferring** the Baird movement? Wouldn't it be easier to make a double front-and-rear combination shutter for a complete Baird machine? Superior 5-to-1 intermittents have always been with us right here in the good old U.S.A.! The Powers pin-cross movement wasn't too bad; and the best 5-to-1 movement of all—the Simplex "Hi-Speed"—is readily available for one of the most modern of high-quality projectors, the Simplex X-L.

2. The article you refer to in the February 1957 issue of IP was the concluding installment of a series by Jose M. Ruiz. In it he described the Radion accelerated geneva movement and presented a diagram showing how this movement works. You will find it on page 13 of the January 1957 issue of IP. Neither Senor Ruiz nor the writer has ever said that the Radion movement is an improvement over domestic methods: in fact, it isn't even a 5-to-1 movement! The Radion II intermittent has a pulldown ratio of only 4.143-to-1, and is purposely made with an asymmetrical acceleration-deceleration characteristic, which I don't like. The Radion II projector is made by Cameca, 103, Bd. Saint-Denis, Courbevoie, a suburb of Paris, France.

3. We know of no geneva projectors which have been converted to the use of the 5-to-1 pin-cross intermittent, and do not know of anyone who is contemplating this project. It can be done at a great deal of expense and hard work, but it is most unlikely. The pin-cross movement was manufactured exclusively by the Nicholas Power Company, and though definitely a superior unit for its day, and possessing the advantages of a rapid pulldown, it could not be made to function as accurately as a geneva movement. In fact, Power had only two or three master machinists who could satisfactorily turn out these tricky intermittent movements. The smallest error in the spacing of the roller-pins of the cross-wheel caused the picture to jiggle or dance rapidly—6 times a second when the film is run at 24 frames per second. Slight wear of the rollers had the same annoying effect; and there was nothing the projectionist could do to stop it.

The Simplex X-L 5-to-1 "Hi-Speed" accelerated geneva movement has the same accuracy as a regular 3-to-1 Simplex X-L intermittent which, as you know, is unsurpassed by any other intermittent in the world. It is quiet-running, kind to the film, and absolutely rocksteady. Used with 63° shutter blades, this 5-to-1 movement gives fully 130% the picture brightness obtained with a 3-to-1 movement used with the narrowest possible shutter blades (90°). Or a 3-blade shutter can be used with the Hi-Speed intermittent under certain conditions to eliminate all traces of the flicker sometimes seen in the bright highlights of pictures (clouds, snow, white buildings, etc.) projected with 3-to-1 intermittents and 2-blade shutters. The difference is a difference in shutter frequencies—72 cycles per second for 3-blade shutters and 48 cycles for 2-blade shutters.

Another high-quality American projector manufacturer also has an accelerated geneva movement, and this has a pulldown ratio of fully 6-to-1! I don't mention the name of this manufacturer because he is not yet mass-producing his new intermittent for sale to the theatres. He will do so the moment that economic conditions warrant making new equipment units available, which we all hope will be very soon. So, you see, the best projectors fitted with the most advanced components of the highest possible quality are made right here in the United States.

IP was the first magazine in the entire motion-picture field to publish

a technical article on the Simplex 5-to-1 intermittent. See "Projection with Hi-Speed Intermittents" beginning on page 7 of the November 1957 issue. There are photos of the new movement on p. 8, and diagrams on p. 9. Some designers incline to favor the "drunk-cam" type of intermittent for more rapid pulldowns. These have been discussed in detail in the Ruiz articles. The oscillating-cam geneva movement designed by J. G. Jackson was described in an article in the February 1955 issue of IP, and incorporated into 35-mm projectors for TV service.

An INTERNATIONAL PROJECTIONIST file is a mine of information on intermittent movements for motion-picture projectors. Following is a bibliography of the most detailed articles we have presented on this topic:

"The Geneva Intermittent Movement" by A. C. Schroeder, I, March 1950; II, April 1950; III, May 1950.

"Heart of the Projector Mechanism" by Robert A. Mitchell, I, July 1952; II, August 1952; III, September 1952.

"A 60-Degree Intermittent Movement" by J. G. Jackson, February 1955.

"Fast-Pulldown Intermittent Movements" by Jose M. Ruiz, November 1955.

"The Versatile Claw Intermittent" by Jose M. Ruiz, March 1956.

"Faster Pulldown Geneva Movements" by Jose M. Ruiz, I, December 1956; II, January 1957; III, February 1957.

"Projection with Hi-Speed Intermittents" by Robert A. Mitchell, November 1957.

"Intermittent Movements for 16-mm Projectors" by Robert A. Mitchell, April 1959.

Editor of IP:

I have just read with interest the A-V article entitled "Rear-Projection Screens: A Neglected A-V Aid" (IP for February 1960, pp. 14, 15). While the article is true in what it states, I sinecerly believe that educators throughout the country have given ample consideration to rear-projection screens—and a resounding veto.

In naming some of the available rear-projection boxes you gave sizes which prove beyond doubt that the pictures are much too small to accommodate a normal classroom. Few among twenty-five students in such a classroom could obtain an adequate view of the picture because of its tiny size.

Even though the small projection box with its mirror takes care of the image reversal necessary for showing sound motion pictures on rear-projection screens, an exterior mirror setup is cumbersome and unsatisfactory. The

(Continued on Page 16)

Fred B. O'Mara Named V-P by Union Carbide

NEW YORK—Fred B. O'Mara has been named vice president in charge of production of National Carbon Co., division of Union Carbide Corp., it was announced by James R. Johnstone, division president. O'Mara has been director of manufacturing for National Carbon since early this year. Previous to that he was marketing manager of electrode products. He joined Union Carbide in 1936 following graduation from college. In his new position, he will continue to be located at National Carbon's production headquarters in Cleveland.

Unions In Pay TV Battle

NEW YORK—Two coast labor unions have lined up with exhibitors in their campaign against pay TV. Checks have been sent Philip F. Harling, chairman of the Joint Committee Against Toll-TV and the Theatre Owners of America's Anti-Pay TV Committee, from Local 9, AFL-CIO Theatre and Amusement Janitors Union of San Francisco, and Local 428, International Alliance of Theatrical and Stage Employes of Stockton, Cal.

LETTERS

(Continued from Page 15)

problem of setting up the equipment to get the mirror precisely positioned and the entire unit properly adjusted is one that can be handled only by highly experienced personnel. Frankly, I don't believe that personnel of this order are likely to be recruited from the ranks of school children.

When all is considered, the purchase of darkening shades must be added to the cost of the rear-projection screen if high-quality projection is desired, as it should be. It is more economical to buy shades which darken the room completely; and when these are installed, there is no longer any need for a rear-projection screen. The dark room permits front projection with the much greater degree of image quality possible only with front-projection screens, a picture of large size, and comfortable viewing by a much larger number of students.

SEYMOUR JACOB,
RADIANT MANUFACTURING CORP.
Morton Grove, Illinois

Editor's Reply:

The varied activities of the modern classroom require us to recognize the need for **both** types of projection screen, rear and front. The small size of the projected picture, the need for darkening the area behind the screen (which is often inconvenient), the necessity for light-beam reversal when showing sound movies, and the excessively directional characteristics of most rear-projection screens are among the factors which militate against their use.

In spite of these drawbacks, however, it must in all fairness be conceded that there are times when a small, bright rear-projection picture can be used to advantage, particularly in art and science classes when slides are best viewed in fully illuminated rooms for purpose of note-taking, copying, and comparison with textbook material. This does not mean that rear screens can ever take the place of general-purpose front screens, which are available in a wide variety of reflective surfaces for many different purposes. Preference is on the side of the large front screen in a darkened room for the most effective presentation of motion pictures and most slide and slide-film programs before large groups of students.

MONTHLY CHAT

(Continued from Page 5)

now belongs to the unbridled and virtually unregulated "freedom" of American TV, which is welcomed to it, while the movie theatre has increasingly come to be regarded as a haven of refuge where refreshing entertainment and pleasant relaxation are uninterrupted by the pitchman's raucous ballyhoo.

Not even good pictures on pay-TV can be considered as adequate substitutes for the sharply focused, colorful, and properly presented attractions of the properly appointed motion-picture theatre.

There are other, and better, ways for the theatre to render community service than by presenting nauseous trailers for every corset shop and hot-dog stand on the street! It can open its doors mornings to civic organizations. It can make its stage available to local dramatic and music clubs. Its foyer can function as a salon for school, art-society, and garden-club exhibits, etc.

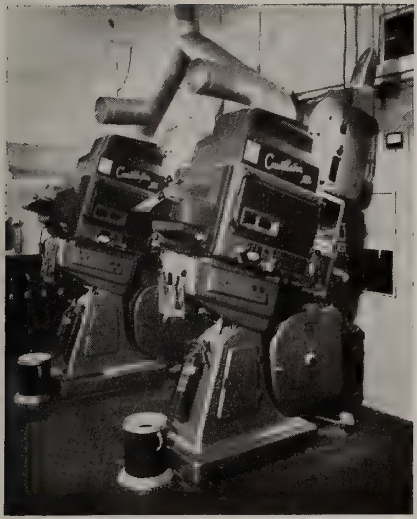
The screening of TV-type advertising commercials is neither good taste nor good business.

The preview trailers for coming attractions constitute the single exception to the prohibition of screen advertising. The "prevues" are necessary and desirable, inasmuch as they offer samples on the screen of the screen's own wares, and provide a better indication of the content and character of future presentations than do the customary, but of course also necessary, newspaper and magazine ads. And what we have said with indoor theatres in mind applies with equal validity to drive-in theatres. The elimination of all "outside" screen advertising is an important part of any commonsense policy of successful theatre operation.

SMPTE GETS USOE GRANT

NEW YORK, N.Y., June 14—The United States Office of Education has awarded a $24,000 contract to the Society of Motion Picture and Television Engineers to plan and conduct a conference devoted to the evaluation of the adequacy and suitability of presently available types of audio visual equipment and devices in terms of current and future educational needs; and the formulation of engineering principles that will serve as guideposts in the development of audio visual devices for use in education.

The study will be conducted under the direction of John Flory of Eastman Kodak Company.



Constellation "170" arc lamps, mounted on National "70" Bauer projectors, have been installed by Tom Head, projection supervisor of General Sound and Theatre Equipment Ltd., Toronto, Ontario, for projection of the MGM 70 mm film production "Ben Hur" at the University Theatre, Toronto.

Steve B. Newman, IATSE VP, Dies

Steve B. Newman, former vice-president and assistant international president of the IATSE, died at his home in San Francisco after a long illness. He was 82 years old.

A member of the organization since 1897, he originally joined Stage Employes Local 47, Pueblo, Col., and in 1901 became a charter member of Local 99, Salt Lake City, Utah, where he had been born and raised. Later, moving to the West Coast, he joined San Francisco Local 16, Los Angeles Local 33 and Hollywood Studio Grips Local 80. He was also an honorary member of San Francisco Operators Local 162.

Mr. Newman was elected third international vice-president in 1919 and later served as assistant international president under president Charles C. Shay and as an international representative under four administrations, including the current one headed by Richard F. Walsh. He was a leader of the winning fights to equalise salaries and conditions for road men and to obtain sleeping-car provision in road contracts. He played a key role in successful settlement of the prolonged strike at the Fox Theatres in New York City and New Jersey and helped steer the course of the IATSE in support of the Actors Equity strike for recognition in 1919. Assigned to Hollywood in the 1920's and early 30's, he was instrumental in organizing most of the technicians there into the old Studio Mechanics Local 37 and later in establishing several of the present day unions.

Mr. Newman had an important hand in organizing the California State Theatrical Federation and served as a vice president of the Los Angeles Central Labor Council and the California State Federation of Labor. He was active at all conventions of the Alliance up to and including the one held at Kansas City in 1956.

COOLEY BATTLES TAX

Clyde Cooley, business agent of Operators Local 343, Omaha, Neb., has been a prime mover in opposition to a proposed 8 percent amusement tax there. He organized theatre owners, night club operators and proprietors of bowling alleys and dance halls into a group known as the Omaha Public Recreation Assoc. The association obtained 20,000 signatures of protest in three days, explaining to the public that this would be the first sales tax in Nebraska and would open the way for many others.

U.S. House Endorses High Speed Congress

NEW YORK — The United States House of Representatives, concurring in a Senate Resolution, has unanimously endorsed the Fifth International Congress on High Speed Photography. This Resolution declares that "the democratic environment of the free world is the best environment for achievement in science," and urges that "all interested agencies of the Federal Government participate actively to the greatest practicable extent."

This international scientific meeting will take place October 16-22, 1960 at the Sheraton Park Hotel in Washington, D. C. under the sponsorship of the Society of Motion Picture and Television Engineers.

"It is the belief of the Congress," the Resolution states, "that scientists and engineers have special advantages and opportunities to assist in achieving international understanding since the laws and concepts of science cross all national and ideological boundaries."

The Resolution was introduced originally in the United States Senate by Senator Warren G. Magnuson of Washington, Chairman of the Senate Committee on Interstate and Foreign Commerce. It was passed unanimously by the Upper House at that time.

The Resolution was brought before the House with the endorsement of the House Committee on Foreign Affairs under the chairmanship of Congressman Thomas E. Morgan of Pennsylvania.

According to Chairman Max D. Beard, the scope of the Fifth Congress will include a survey of various fields of the sciences now using high speed photography as a basic tool in research and development and an exploration of new applications and techniques. Delegates from twenty foreign countries are expected to attend the Congress.

President of Motiograph Praises IP Tech. Editor's Objective Reporting

Editor, IP:

We read the article on curved film gates in the June issue of IP with great interest and appreciation for its technical accuracy. Robert A. Mitchell's writing was clear and concise.

As we have said on previous occasions, we feel that the Mitchell articles are eminently fair to all concerned because of their objective quality, and the weight of our opinion in this respect runs to Motiograph's 64 years of experience in building both production and experimental models of projectors.

FRED C. MATTHEWS
Motiograph, Inc.
Chicago, Illinois

Editor, IP:

A heartfelt "thanks" to IP for J. G. Jackson's interesting article on continuous projectors ("Non-Intermittent Projector Operating Principles Detailed; New Development Introduced," IP for May 1960, p. 5 **ct seq.** However, there is one point in connection with Mr. Jackson's projector I fail to understand.

Because the film runs with a continuous motion past the aperture of the Jackson projector, what is to prevent a fadeaway of light at the top and bottom of the screen, or a little of the bottom of the film-frames from showing above the top of the screen, and a little of the top of the frames from showing below the bottom of the screen? In other words, just how is a satisfactory masking, or framing, of the picture accomplished?

CLIFFORD L. McALLISTER
Lowell, Massachusetts

To which Mr. Jackson replies:

There is no fadeoff of light above the top and below the bottom of the screen, providing the spot is properly jector. The light is even all over the screen, provided the spot is properly focused on the aperture, exactly the same as in any other projector. The one exception: if the spot were too much out-of-line on the aperture, the dark portion would tend to travel downward from top to bottom of the screen and might cause a 24-cycle flicker. This would be the fault of the projectionists, not of the projector.

As to running the projector with no film in it:—All light passing through the aperture is used to form the image, so none is lost, but in this case the rectangle of white light is greater than the height of the screen. With film in the aperture, the frameline absorbs this light which would otherwise go to the screen-masking. This holds true no matter where the frameline happens to be in the aperture, top, bottom, or center. If the frameline were white, then the light would get through to the masking. Without film, the rectangle of light is clear and even.

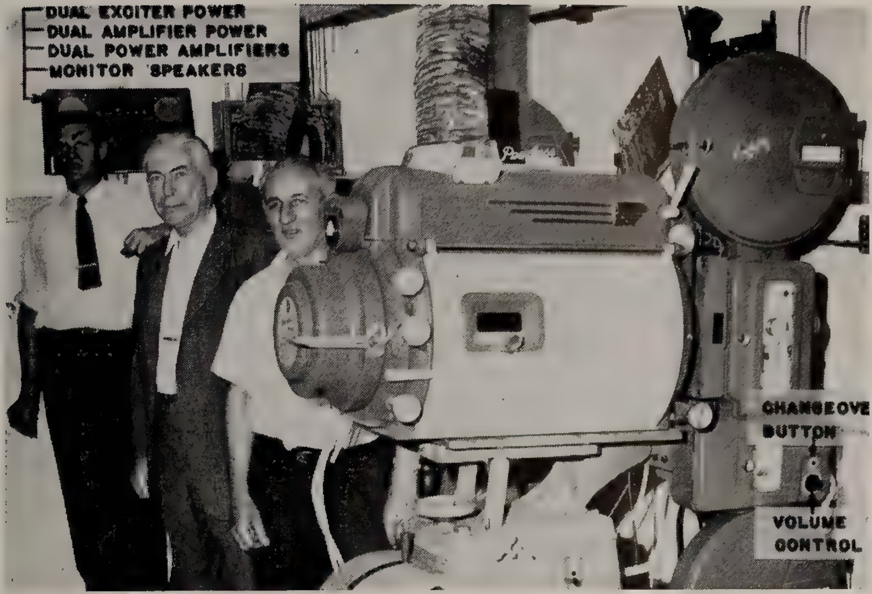
Incidentally, the Mechau projector has this fault. I have been in touch with Dick Bartel whose picture was in the December issue (p. 12). He tells me that if the spot gets out-of-focus or out-of-line, there will be light on the screen masking. This is understandable, as the light will then fall onto the wrong mirrors at the wrong time. This does not happen with mine, as the only light that can get to the screen-masking is through the frameline.

In the Mechau the pictures dissolve from one to the next. In mine they "wipe" from one to another, as there is no overlap. I trust this explains Mr. McAllister's question; and I should be glad to enter further discussion at any time.

J. G. JACKSON
Port Alberni, B. C.

NEW S.O.S. TRIPOD

S.O.S. Cinema Supply Corp., has announced its new ball-socket Gyro-Sphere Junior Tripod. By means of a single bull's-eye spirit level, the top plate is horizontally adjusted no matter how tilted the tripod or uneven the ground. Both friction and fluid heads are accepted by the GyroSphere and work independently of it. Present owners of S.O.S. Junior and Professional Junior Tripods may purchase the ball socket and adapter for installation on their tripods. Other features include twin-point shoes and one piece leg locks.



DEBUT—The Century Projector transistorized sound reproducing system made its debut at the Mall Theatre, a Charles Moss Enterprise, in July. In the picture above (left to right) is Michael Chitty, designer of the system and outstanding leader in the field of transistors, Frank E. Cahill, Jr. vice president of Century Projector Corp., and Milton Berk, chief projectionist, Capitol Theatre, New York.

Animated Seminar Conducted by Florman & Babb

NEW YORK—Audio-visual experts from almost 100 industrial firms and photographic and government agencies recently attended a four-day seminar and workshop in New York, on animated film techniques, the first of its kind, sponsored by Florman & Babb, motion picture equipment suppliers.

Sessions were held at the New York Trade Show Building, and explored the entire field on the use of animated films as well as detailed workshop how-to-do it courses.

Some of the organizations who sent representatives are: Bell Telephone Co., General Motors, Ford, Eastman Kodak, I.B.M., General Electric, Harvard, Purdue, Lockheed, Federal Aviation Center, Walter Reed Hospital, Republic Aviation, Canadian Broadcasting Co., U.S. Army Pictorial Center, Redstone Arsenal, U.S. Naval Ordnance Laboratory, Thiokol Chemical Corp., Argonne National Laboratory, North American Aviation, Martin, Boeing, Shell Oil Co., Sperry Gyroscope, etc., etc.

The workshop sessions were conducted by Florman & Babb's Arthur Florman, Warren C. Portman and Charles Lipow, who demonstrated and insrtucted in animation photography using the F. & B. Triplex and Portman Animation Stands.

H. E. Brown Retires As Strong Electric VP

The retirement of Harold E. Brown, of The Strong Electric Corp., Toledo, has been announced by Arthur J. Hatch, president.

Brown joined Strong Electric as office manager in 1935, going over from General Electric. He was elected vice president in charge of sales in 1954. Brown will continue to serve as part time consultant to the company.

Strong Electric is currently observing a Third of a Century of Progress in projection arc lamp development, an event which has been given widespread recognition in the national trade press. Its plant in Toledo manufactures, in addition to projection arc lamps, a line of slide projectors, spotlights, aircraft searchlights for the military, rectifiers, reflectors, printing and camera lamps for the graphic arts field, arc image furnaces for outer space research and solar furnaces.

Ampex Appointments

REDWOOD CITY, CAL.—Gerald F. Rester and Frank Gonzalez Jr. have received appointments as sales managers for the video products division of Ampex Professional Products Co., Neal K. McNaughten, company manager, has announced.

Rester has been appointed eastern regional sales manager and Gonzalez has been named southwestern regional sales manager.

Ampex Goes "Down Under"

REDWOOD CITY, Cal., — Ampex Australia, Pty., Ltd., has been established as a subsidiary of Ampex International S. A. of Fribourg, Switzerland, according to Phillip L. Gundy, senior vice president of the parent Ampex Corporation here and president of the Swiss firm.

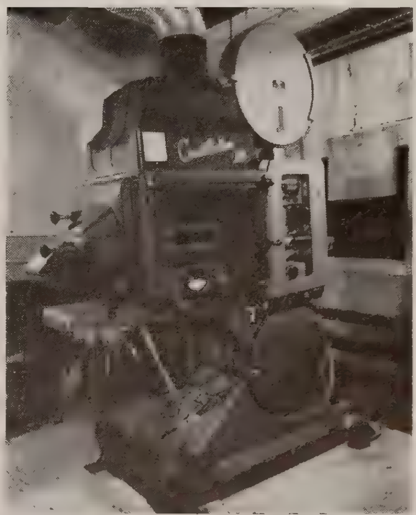
Edmund J. Aleks, former Western U. S. district sales manager for Ampex TV recording equipment, has been named managing director of the new Austrailian company. Aleks is on survey visit to the Australian and New Zealand markets.

Initially, the new firm will step-up marketing for the Ampex Videotape recorder in the two "down under" nations and direct marketing support for franchised distributors of other Ampex products.

Gundy said Ampex Australia would study the possibility of assembling certain Ampex products in Australia and later consider the establishment of Ampex manufacturing facilities.

Of some 630 Videotape television recorders now in use throughout the world, nine have been purchased by Australian television stations and another is operated by a research facility. Three others are on order.

In addition, a large number of Australian and New Zealand radio stations and recording firms use Ampex Professional audio recorders. Ampex Instrumentation recorders are being installed on Australia's Woomera Missile Range.



Shown is an installation of Constellation projection lamps on Phillips Norelco projectors made by National Theatre Supply at the Eckel Theatre, Syracuse, N.Y., for the presentation of 70 mm productions.

IATSE

(Continued from Page 7)

ing that the lower taxes paid by companies and stars working outside the United States reacts to the detriment of projectionist employees and other IA members within the United States.

IA received a resolution not to act on anything that would be detrimental or oppose the advent of pay-television, taking the position that the American public should determine whether or not pay-TV should become a reality. It also received one on the other side of the fence. (See below).

The so called "runaway" production of American motion pictures outside of the United States was roundly condemned by IA resolution and the organization announced its intention to work for the enactment of legislation to back up its complaint. A major resolution is the request that Congress investigate the adverse effects of the divorcement action on the motion picture industry; its production distribution and exhibition costs: the tax regulations affective earned income in foreign countries, with a view for remedial action to assist the industry, including subsidies if necessary.

Herbert Aller, of Local 659 proposed that the IA request a hearing before the Senate Finance committee and the Secretary of Commerce as well as the Internal Revenue Board, convene a meeting of the presidents of the major motion picture producers, the major independent producers and United Artists Corp., as well as representatives of the major advertising agencies of the United States, in order to summon to these hearings representatives of locals affected by diminishing motion picture production.

Mr. Aller suggested that representatives of the locals affected by these practices be convened after the requests for hearings have been taken "so that a reappraisal may be made and further plans formulated to protect the interests of the members of the Alliance."

A resolution by members of Local 306 stated that pay-TV "would eventually eliminate free TV," cause the eventual closing of all motion picture theatres and throw thousands of projectionists and stage hands out of work, they opposed the new medium via resolution.

The resolution said that "pay TV would give but only temporary employment impetus in increased production (much of which may be on video tape), since experience has shown that TV burns up motion picture features as well as other talent which inevitably will result in the use of fewer motion picture features."

In its official convention bulletin, the IATSE summed up problems of the past, as well as those problems of the present which they considered during the 45th International Convention.

High on the slate of present problems was the membership shrinkage which has hampered the operation of many locals, especially in the smaller cities, underscoring the need for mergers and possibly other remedial steps. Another problem on the convention's agenda was the recruiting of new craftsmen in the various fields.

In the bulletin, the IA recalls problems of the past which the members met:

"The facing of tough problems in convention at Chicago will be nothing new to IA delegates. This will be the fourth assembly in the midwest metropolis in the 67 year history of the Alliance. The last one, our 38th convention in 1946, held at the same hotel (then named the Stevens) came at a time when the organization was deep in the fight against Communist infiltration of the Hollywood studios. The firm steps taken by the delegates that year, giving President Walsh authority to deal forcefully with the red menace and to keep our West Coast organization intact, still stands out as a highlight of our history.

Incidentally, it was also at Chicago in 1946 that the decision was made to change the character of the Official Bulletin and send each issue directly to the homes of the individual members.

Much further back in history, during the summer of 1915, the 22nd convention of the Alliance was held at Chicago's Arcadia Hall, at which time 280 delegates represented 261 locals. Compared with our present size, that was a very small union. Significantly, however, the era of great growth had begun. President Charles C. Shay reported that 159 new locals had been chartered during the preceding two years. The expanding movie field was being organized. The stage, however, was hard hit. Many road men had been threatened with arrest for loitering while awaiting employment and the general office had provided a special room where they could 'at least find shelter from the elements.'

In 1915, also, the locals were finding it more and more necessary to turn to International officers for assistance with their problems. Up till that time, each local had been required to pay the visting field man's expenses, but in 1915 that policy was changed.

The first convention held at Chicago was the second in the history of the old National Alliance—1894. Fourteen delegates represented the same number of locals. Lee M. Hart, one of the great early architects of the organization, was elected president. The proceedings of that early session are quite sketchy. However, two actions stand out. A committee was appointed to get designs for a pin for the members, and it was decided to 'proceed at once to get a charter from the American Federation of Labor.' "

Transistor Sound In N. J. Theatre

PARAMUS, N.J. — The first all transistor theatre sound system, developed by Century Projector Corp., and Reeves Soundcraft is being installed here in Charles B. Moss' new Mall Theatre.

According to Moss, the transistor system represents the first major breakthrough in sound reproduction since the introduction of talkies. In addition to giving the audience high fidelity sound, Moss said its advantages included durability, simplicity of installation, operation and maintenance. It's also a big space saver, since the all-transistor system can be held in the palm of the hand and does not utilize the areas of wall and booth space required by prevailing systems.

Low-Light Uses for New Eastman Kodak Films

HOLLYWOOD — New Eastman Kodak film is being put to use here. The company's new Double X Panchromatic film will be used by Murray-Wood Productions in shooting the feature-length "Hoodlum Priest." The film will be used to utilize natural lighting conditions with the minimum amount of camera and electrical equipment.

The use of new Eastman Kodak color film in low light situations was also demonstrated recently for members of the American Society of Cinematographers, when John Waner of Eastman Kodak's motion picture film department showed techniques for using the new Eastman Ektachrome E R films which carry exposure ratings in the same range as some black and white materials.

Bell & Howell Appoints J. Tomes, F. A. Jones

CHICAGO—Frank A. Jones has been named associate director of public relations at the Bell & Howell headquarters in Chicago.

The company has also appointed James Tomes to its executive offices.

Knowledge, Equipment, Must Be Improved, VICOM Head Says

by FRED AUFHAUSER
PRESIDENT, VICOM, INC.

Let's review the new demands placed upon the optical industry as a background to the reasoning which led me to introduce our new Visual Image Compensator.

The requirements of a good lens are:

1. Contrast—and by this we mean a good, all-around contrasting picture which is neither flat nor without kick and which can be viewed as such by the average eye.

2. Resolution—only half of the story of lens quality and, in my opinion, highly overrated since it is merely a term describing that the lens resolves a certain number of lines per mm at various parts of the picture. As far as I know, no one in the Industry has set up a specific requirement as to resolving power. These requirements depend greatly on the finished print which, for argument's sake, are about one-half as good as the resolving power of the lens and I consider that an acceptable projection lens should resolve at least 80 lines per mm in the center and 56 lines at the edge.

3. Distortion—can be identified by looking at straight lines projected on the screen. If these lines are seen to be curved, there is objectionable distortion. In my opinion, no curvature should be visible with a good projection lens.

4. Field Curvature — is detected when the lens is out of focus at the edge of the picture when focused at the center.

5. Coverage — the lens must have sufficient angular coverage to properly reproduce what is on the picture. While many lenses give sufficient light on the edge of the film, this does not necessarily mean they give good definition at the edge of the picture.

6. Price — unfortunately most projection difficulties today stem from the plain fact that the theatre owners and his technical advisers have not been properly trained to recognize that the projection lens really represents the heart of the operation and that such an item costs a lot of money and requires a lot of care. A really first-class lens required for today's large screen presentation would cost at least $2,000. For this reason the majority of theatres merely use a compromise, as we, the manufacturers, simply could not sell such an expensive lens. More money, unfortunately, is being made on popcorn than on the picture itself.

Now let's review various projection difficulties:

Why don't we have a steady, sharp picture?—When small screens were used, the projection lens hardly ever was below 5" focal length. This, together with the Academy aperture, would mean that the angular coverage never exceeded about 12 to 14 degrees, but today when we talk in terms of 2" to 4" lenses, we are projecting with an angular coverage as high as 34 degrees, or nearly 3 times as large. As the angular coverage increases, the depth of focus in the optical design decreases and the result is that you have a lens which does not maintain steady focus.

A good projection lens must have sufficient depth of focus to absorb the other problems which are created, such as buckling due to heat, gate pressure which is kept down to relieve friction, and basic imperfections in the actual photography of the film.

I consider the depth of focus as the most important need and requirement of any projection lens. I think this is even more important than maximum contrast or resolution, and whatever future design of a lens is forthcoming, due consideration must be given to the depth of focus.

We have no specific up-to-date figures or data as to the average depth of focus required and we, the manufacturers, can only go by the projectionists everyday experience and opinion, but we do know that if we use any "prime lens" focal length below 4" with a 35mm print, we are inviting difficulties.

The big increases in magnification needed to fill the large screens open our eyes to many other problems which we have never seen heretofore, such as jumps, weaves, and overall steadiness of the print.

Some theatres now operating 70mm

equipment and I think they have seen these imperfections. But I want to emphasize that when we talk about a 4" lens with 35mm, the equivalent with 70mm would be about 8".

These points, then, account for our decision to make the new Visual Image Compensator because we can now use prime lenses half the focal length we would normally require. For example, let's say your basic projection lens requirement is a 2". We then use a standard 4" lens which we know is good and we attach to this the VIC; this changes and corrects the image to perform equally to a 2" lens.

Therefore, we have succeeded in maintaining the basic depth of focus of a 4", yet have also succeeded in overcoming the optical errors in this basic prime lens while also conforming truly to the standard of a wide angle lens.

Actually there have been many years of research behind VIC and this basic solution. With VIC, as in cinemascope, we merely change the size of a picture after it is projected by the prime lens. We not only do this, but also further correct the image as to contrast and resolution. This, in itself, is quite an achievement because we can now project wide screens with the same basic qualities which we had with 4" and longer focal length lenses using the Academy frame.

So we use a long focal length lens to maintain the depth of focus. We optically correct the picture image coming from this prime lens, improving its resolution and contrast as required for the larger magnification, and we also enlarge the picture while eliminating the visible fall-off which has been inherent with all carbon arc lamps.

Basically, I favor anything for the Motion Picture Industry which is not connected with any specific standards simply because we are living in a very competitive world and unless theatre owners, manufacturers, suppliers, dealers and projectionists, are being constantly alerted by new trends, etc., we have a tendency to fall asleep.

To me the problem today is not 70mm or 35mm. The problem simply is for a theatre owner to decide — "Can my theatre draw an audience or not?" If he decides it can, he has no choice but to remodel the theatre according to the latest taste of his public. There is no difference in the small grocery giving way to the modern supermarket, or the second car giving way to a boat. Today when we have to shell out our hard-earned money, we are demanding that we get the best for it in return and this includes the very best in the projection booths as well as the very best in the orchestra seats or in the washrooms, and I might add hereto, the very best in operators and management of the theatre.

The role of an operator, too, is increasing in stature from the level of turning the switch to the level of being a projection engineer. It is, therefore, essential that projectionists as a group, improve their individual training and "know-how" of all the technical aspects of their booths.

To give a few examples of what I am referring to: they learn how to coordinate their light output with the density of a print; to maintain and control the friction within the gate at all times; to do a better job in monitoring the sound and to constantly be alert to the change of focus of the picture.

Go out—talk to your neighbor and find out why he doesn't like the theatre—and you will be amazed at what you hear!

Throughout my travels during the year, I have talked with people everywhere and for the first time in my twelve years in the theatre lens business do I hear specific complaints by the audience strictly on technical grounds—they are learning — watch out — and their complaints are such as—too brilliant a picture—the sound is too loud — or the focus in the picture constantly changes. Therefore, it is absolutely essential that if the Theatre Industry is going to survive as another medium of entertainment, they, the new projection engineers, must know all the tricks in operating their theatres, and their equipment must be the best available at all times. Theatre owners then should set aside a certain percentage of their income every month for the purpose of replacing equipment, just as any manufacturer does today—and for goodness' sake, stop approving a piece of equipment just because it is cheaper.

Editor's Note: The above address was given at the spring meeting of the New York State Association of Motion Picture Projectionists. (See IP, June, 1960.)

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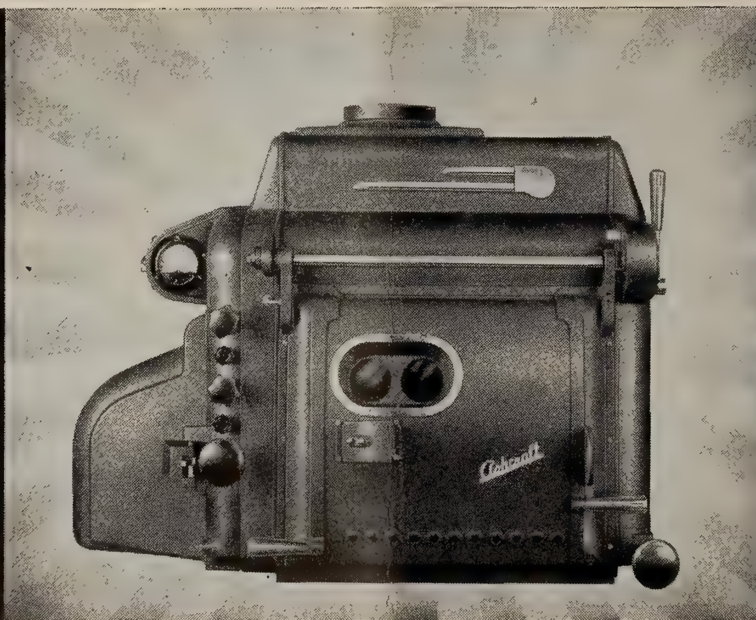

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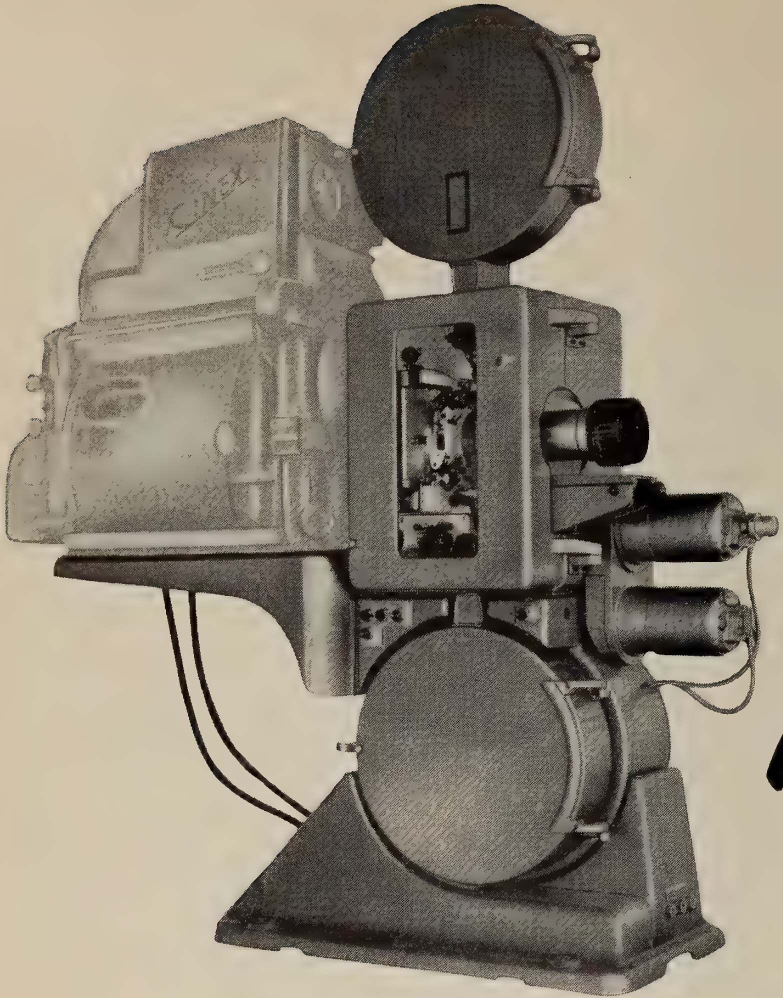

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RAY GALLO
General Manager

MIDWEST OFFICE
4616 Washburn Avenue South
Minneapolis 10 Minnesota

FRANK W. COOLEY, JR.
Editor and Publisher

R. ENTRACHT
Associate Publisher

RAY GALLO
General Manager

R. A. MITCHELL
Technical Editor

In This Issue . . .

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MONTHLY CHAT

THE MYSTERIOUS CASE OF GREEN-PRINT DAMAGE

IP WAS RECENTLY apprised by Brother Frank Griesel of Oakland, California, of a real "weirdie" of a projection mishap. We'll bet it wouldn't happen again in a millenium, but you can never tell. Something had gone wrong with the gate-tension adjustment on one of the late-model projectors in a West Coast installation. It was a totally unexpected occurrence, as this make of projector has been highly touted; and it was not the projectionists' fault.

What happened? A "green" (brand-new) print was being run, and the gate-tension indicator was set for the lightest possible tension, as it should be. But something either let go, or failed to let go, and the fresh print was subjected to terrific tension. At first nothing wrong was suspected. Says Brother Griesel: "There was no noise to give an inkling that the film was being damaged, as is usually the case. Moreover, we have not been able to locate another single instance of this sort of trouble with this make of projector."

And there you have it — disaster right out of the blue. In many instances, however, the projectors may be mechanically sound, and the cause of green-print damage is either ignorance or carelessness. The tension, set high for a steady screen image with an oily, well-seasoned print, is left unchanged when a print fresh from the laboratory comes along. In the case of such older projectors as the Simplex Regular and Super Simplex, this cannot be helped, as it is not feasible to keep changing the tension of the pronged pad springs. All that can be done is to set the springs for the average type of print used in the theatre and resort to "oiling" or hope for the best when an unlubricated green print shows up for its initial screening.

The emulsion of green prints is soft, moist, easily melted in the heat of the gate, and easily scratched by the bone-hard deposits of gelatine that come from the film and stick to the film runners. If the gate tension is too high the green film will "stick," especially at arc currents much over 60 amperes when no heat filters are used.

What does the "sticking" print do? It makes a loud chattering noise which warns the projectionist of trouble ahead. And then, as emulsion melts from the perforation margins of the film, the print slips and "overshoots" on the intermittent sprocket. This is visible on the screen as a violent jumping and dancing of the picture. Then the gelatine hardens and drags the film. The sprocket holes are strained and even chipped or torn. A completely good print may be ruined in one showing!

Green prints are usually run in European theatres with special velvet-covered gate runners which are temporarily substituted for the steel ones. Velvet runners are practically unknown in America. And when Regular and Super mechanisms are used in subsequent-run theatres, where high gate pressure is the norm, the occasional receipt of a green print sends the projectionist to the oil-can. Now, the practice of oiling prints has been strongly condemned by most authorities, but most of these authorities who have ever run a motion-picture machine will agree that user-lubrication of green prints is a necessary evil where old-style machines are used.

The projectionist applies a little oil to the tip of his finger and rubs it upon the edges of the roll of film before running it for the first time. Both sides of the roll are lightly oiled in this manner to prevent sidesway; and only the merest trace of oil is applied. Squirting oil upon the film as

(Continued on Page 22)

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» COMPREHENSIVE
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Volume 35 September 1960 Number 9

THE DESIGN OF SHUTTERS FOR MODERN PROJECTION

By ROBERT A. MITCHELL, Technical Director

PART II

THE DIAMETER of the "effective" light beam at any point between the aperture of the mechanism and the mirror of the arclamp is determined by considering the 35-mm aperture as a circle 1 inch in diameter, and drawing straight lines from this circle to the corresponding edges of the lamp mirror (Fig. 1 of Part I).

When the shutter blades cut the beam vertically, as in the case of most standard projectors, the "effective" beam is somewhat smaller than this because the height of a projector aperture is somewhat less than 1 inch. Nevertheless, the use of a single rear disc-shutter mechanism with a modern high-speed arclamp (f/1.9 to f/1.7) is a light-wasting practice which should be discouraged.

X-L Shutter Very Efficient

One of the most efficient projector shutters is the cone-type shutter used in the Simplex X-L. This is a rear shutter; but inasmuch as it cuts the light beam only 1 inch from the aperture, the "effective" width of the beam is materially less than 1½ inches **regardless of the speed of the arclamp.** The Simplex X-L is a modern projector designed for modern lamp equipment, and its large, close-working conical shutter retains its rapid cutoff characteristics no matter how great the diameter of the arclamp mirror!

The Simplex X-L shutter, formerly supplied only with non-adjustable blades of several predetermined widths, but now available as an adjustable shutter which permits a change in blade width from 48 to 94 degrees (plenty of leeway to provide for drive-in projection with Simplex X-L 5-to-1 "Hi-Speed" intermittents and bright, ghost-free indoor projection with conventional 3-to-1 intermittents).

The X-L cone shutter is a **single** shutter situated close to the film aperture. A similar high degree of efficiency can be obtained with a **double** shutter placed a short distance farther away from the aperture.

Action of Double Shutters

The term "double shutter" denotes any shutter which cuts into the light beam from two sides at once, completing the cutoff in the middle of the beam, rather than at one side. Consider the old Super Simplex disc shutter. This is a "single shutter" because its blades cut into the light beam in only one direction — down through it. Now suppose that a similar disc shutter is added to the original shutter, **but revolving in the opposite direction.** The familiar Super Simplex shutter is thus converted into a **double** shutter; and such a shutter actually halves the time required to cut the rather wide light beam at a point 5 inches behind the film aperture.

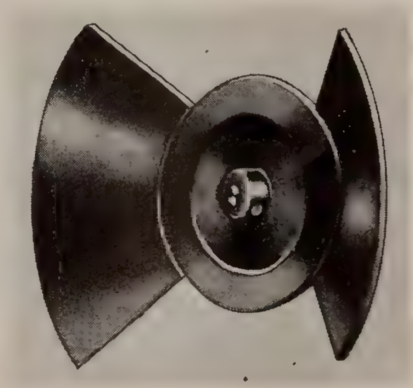


FIG. 1—The Simplex X-L cone shutter of extremely high efficiency. This is available in different blade widths for indoor and drive-in theatres, and for 3-to-1 and 5-to-1 intermittent movements. An X-L adjustable-blade shutter has recently been produced. This will replace the fixed-width cone shutter.

Double disc shutters of this type are found in the RCA Brenkert 80 and in the Century models CC and HH. The edges of the blades of the Brenkert shutters are non-radial, as the shutter shaft is located somewhat higher than the aperture, but the Century shutters are similar to the old Super Simplex disc shutter except for the double shutter used in two 35-mm models.

Double-rotor disc shutters of this rather obsolete type involve undesirably complex drive-gearing and are prone to become noisy. Because they are located so far from the aperture, even their double action fails to attain the cutoff rapidity of such more effective shutters as the Simplex X-L conical single-acting shutter and the Motiograph single-rotor, double-acting cylindrical shutter.

Front-and-Rear Combinations

One of the most interesting, but not wholly satisfactory, attempts to produce a double-shutter action without increasing the mechanical complexity of existing single disc-shutter mechanisms is represented by the Simplex E-7 and the Brenkert 62.

These machines each had a single long shutter shaft which carried a rear disc shutter at one extremity and a similar disc shutter at the front end, in front of the lens. Both shutters revolved in the same direction, but owing to the fact that the light rays are reversed by the projection lens, the two shutters virtually cut the beam in opposite directions.

The front-and-rear disc-shutter combination is unwieldy and ugly in ap-

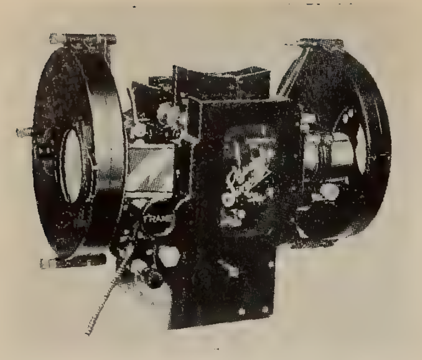


FIG. 2—The Super Simplex fitted with front-and-rear combination shutters of the type first used in the Simplex E-7.

pearance. When the front component is positioned close to the aerial image of the arc mirror in front of the projection lens, the optical efficacy of the front-rear combination is practically that of the front shutter alone. However, this does not mean that the rear component can be eliminated with impunity, for, after all, it does reduce the heating of the film.

Front-and-rear double shutters have now been abandoned by practically all manufacturers. It has been estimated that, to attain results comparable to the Simplex X-L cone shutter with any type of dual disc-shutter construction, more gearing would be required, and it would be necessary to reduce the blade width to such an extent that the risk of travel ghost in the screen image would be a serious certainty.

Barrel Shutter Popular

The cylindrical, or barrel-type, shutter is used in most projectors of European manufacture and in the American Motiograph models H, HU, K, AA, and AAA. Motiograph has not always used barrel shutters, for the first machine made by this long-established manufacturer — the Optigraph of 1898 — employed a small double-rotor cone shutter. It was very good, leading us to wonder why Motiograph ever abandoned a type of shutter which, in modernized form, has re-emerged in such a beaut of a projector as the Simplex X-L.

The first big Motiograph, the 1A of 1908, employed the 3-bladed front disc shutter so popular in silent-movie days when normal film speed was only 1 foot (16 frames) a second. The Model E of 1916 had a similar 3-wing shutter, and the Model F of 1921 (the first fully enclosed Motiograph mechanism) had a 2-wing shutter for higher light transmission. The famous Model H of 1929, fitted with a low-intensity mirror arclamp and reproducers for both sound-on-film and synchronous sound-on-disc (Vitaphone), was the first Motiograph to have a cylindrical rear shutter for better screen illumination and less heat on the film.

It is easy to understand why the single-rotor Motiograph barrel shutter is able to produce a double-cutoff effect on the light beam. This shutter is essentially a cylinder having two large and equal sectors of its circumference cut away on opposite sides to permit the light to pass through in two "flashes" of predetermined duration each time it revolves. The two remaining portions, or blades, of the barrel shutter thus cut the beam in opposite directions, completing the cutoff in the middle of the beam.

Motiograph Shutter Efficient

The efficiency of the cylindrical shutter increases as it is placed closer to the aperture and, up to a limit, as its diameter is increased. Most barrel shutters are from 4 to 5 inches in diameter, the larger sizes being used in certain European machines. In the Motiograph AAA, the blade closest to the film cuts the light only 2 inches from the aperture.

Because both blades of a barrel shutter are in action at the same time, the angular widths of these blades are smaller than those of disc-type shutters. However, it is probably true that the Motiograph AAA cylindrical and the Simplex X-L conical shutters have about the same high degree of optical efficiency — higher than that obtainable with rear disc shutters of any type.

It should be noted that projectors made for showing 70-mm films require the most efficient light transmission, and hence nearly always make use of cylindrical and conical shutters. This is true of such high-quality 35/70-mm projectors as the Victoria X, the Bauer U2 (National-70), and the Philips Norelco.

Low-priced 35-mm projectors which have been adapted for 70-mm service at minimum cost retain the obsolete and unsuitable disc-type shutters they have had for many years. Because these machines are merely adaptations, their manufacturers cannot make use of modern, single-unit construction, but are forced to employ separate units for the magnetic reproducer, the picture mechanism, and the optical reproducer.

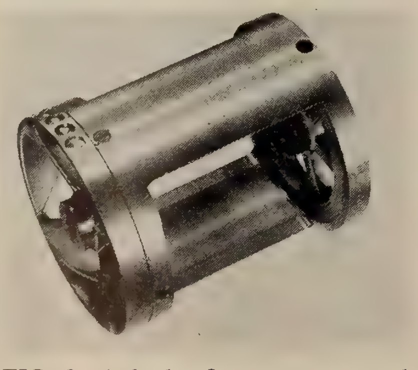


FIG. 3—A high-efficiency Motiograph AA double-action shutter, showing the blades and rotor fins for drawing cool air over the aperture plate.

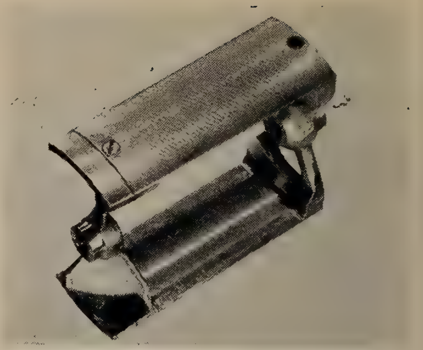


FIG. 4—The wide Motiograph AAA shutter for use with arclamps of high optical speed. These shutters are now available.

Light-Beam Obstructions

Aside from the use of modern rapid-action shutters and the narrowing of shutter blades for maximum light without visible ghosts, one of the more urgent problems confronting the projector manufacturer has been the elimination of all obstructions to the wider light beams produced by modern "fast" arclamps.

Most of the older projection mechanisms have rear-shutter shields, aperture sight boxes, and heat baffles which block much of the light sent to the aperture by f/1.9 and f/1.7 lamp mirrors. Motiograph, as well as Simplex, has long been aware of this problem and take effective measures to insure passage of the light from the largest lamp mirrors through the shutter to the film aperture.

The old Simplex Regular front-shutter mechanism was usually equipped in pre-talkie days with a long, narrow sight box containing red sight-glass panels in its sides. This was placed over the asbestos heat shield directly in back of the aperture plate. This old-style Simplex sight box was intended for use only with vertical-arc condenser lamps having optical speeds ranging from f/3.5 to f/3.0. The writer has used these obsolete sight boxes on front-shutter Regulars with f/2.5 LI mirror arcs, and observed that they obstructed the extreme edges of the arclamp beam, although barely enough to show us as a slight dimming of the edges of the screen image.

The Super Simplex rear-shutter mechanism has a shorter, wider sight box placed between the rear-shutter case

(Continued on Page 20)

YOUR NATIONAL CARBON ENGINEER...

Sells you the best product—gives you the best service!

The illustration shows a NATIONAL CARBON Sales Engineer using a multiple scale ac-dc voltohmmeter for checking incoming a-c line voltage to the booth . . . to determine if taps on the rectifier are set properly . . . and to measure the d-c voltage across the arcs.

These sales engineers – equipped with complete service kits containing the most modern tools in the trade – stand ready to assist you on any lighting problem and to help you realize the ultimate in picture quality.

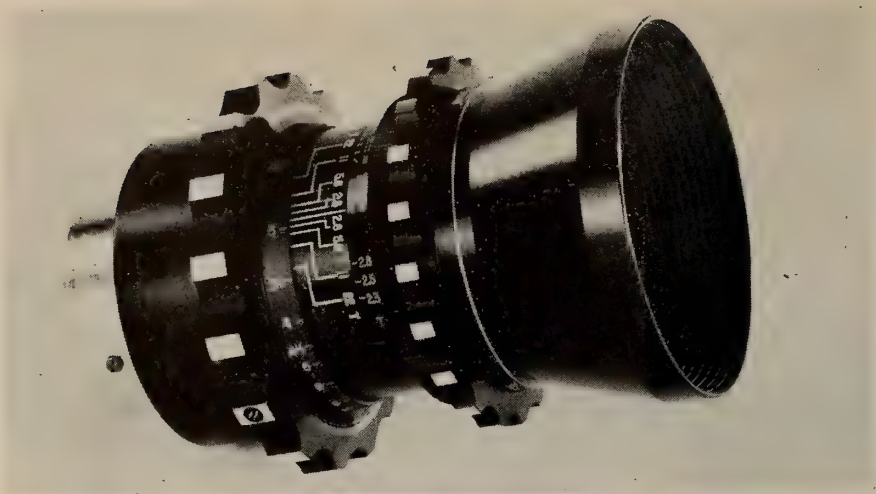
Use "National" projector carbons and call on NATIONAL CARBON for free technical service. For details, ask your NATIONAL CARBON supply dealer or write National Carbon Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. In Canada: Union Carbide Canada Limited, Toronto.

This voltohmmeter—used for determining both ac-dc power readings—is just one of the many precision tools carried in each NATIONAL CARBON Sales Engineer's Kit.

"National" and "Union Carbide" are registered trade-marks for products of

NATIONAL CARBON COMPANY

UNION CARBIDE



The new 75mm Super Baltar lens is one of eight in a new series designed and manufactured by Bausch & Lomb. The Super Baltars are being offered for motion picture, television and special purpose applications. Focal lengths range from 20mm to 9″, with back focal lengths from 33mm to 133mm.

Bausch & Lomb Announces New Lenses

ROCHESTER, N. Y. — Bausch & Lomb announces a new series of Super Baltar Lenses designed for motion picture, television and special purpose applications. The Super Baltar, which marks B&L's continued research in the field of photographic technology, will supplement the Company's present line of Baltar Lenses.

Following in the tradition of the Baltar, the Super Baltar series incorporates a newly designed optical system. Made from new glasses of high index, the Super Baltar has excellent resolution and the most even distribution of light ever offered in a motion picture camera lens. The new series will include a choice of eight lenses, with focal lengths ranging from 20mm to 9″ (speed of f2.0, both f and t stopped). All focal lengths cover 35mm motion picture frame, and lengths from 3″ to 9″ cover 70mm frames. Back focal lengths range from 33mm to 133mm.

Special design of optical systems allows the Super Baltar to be used not only for feature and newsreel motion picture photography, but to meet specifications needed for television, commercial and military use. Engineering facilities make it possible for Bausch & Lomb to offer custom design service to adapt these lenses to individual focusing mounts for camera and other manufacturers. As an example, Super Baltars will first be seen on the new Mitchell R-35 Cameras.

Details on the new Baltar series may be obtained by writing to Photographic Sales Department, Bausch & Lomb Incorporated, Rochester 2, New York, specifying Bulletin No. F-162.

Aufhauser Urges Part Of Theatre Income Be Used For Replacements

UTICA, N.Y. — In a speech before a recent gathering of the New York State Projectionists here, Fred E. Aufhauser, president of Vicom, Inc., urged projectionists to convince their theater operating employers to set aside a set percentage of the monthly box-office income for the purpose of replacing equipment.

Aufhauser told the booth operators that in his travels he is constantly hearing specific complaints from theatre patrons. But now, for the first time, he is hearing complaints on strictly technical grounds—pictures too brilliant, sound too loud and so forth.

At the conference, Aufhauser also discussed Vicom's new Visual Image Compensator.

The VIC, he told the projectionists' meeting, permits the use of prime lenses half the focal length normally required. "For example," he explained, "let's say your basic projection lens requirement is a two-inch lens. We then use a standard four-inch lens which we know is good and we attach to this the VIC; this changes and corrects the image to perform equally to a two-inch lens.

"Therefore, we have succeeded in maintaining the basic depth of focus of a four-inch lens, yet have also succeeded in overcoming the optical errors in this basic prime lens while also conforming to the standard of a wide angle lens.

"With VIC, as in Cinemascope, we

(Continued on Page 22)

Frank H. Riffle Joins Lorraine Carbon

BOONTON, N.J. — Edward Lachman announces the association of Frank H. Riffle with the Lorraine Carbon Company in the capacity of technical engineer and adviser. Riffle, formerly with Motiograph as chief engineer, resigned to enter a business of his own. Previously he was associated with Erpi and Altec Service. Riffle served with the U. S. Army Signal Corps in the Mediterranean Theatre of Operations and received special commendation for his valuable services. He is a member of IATSE Local 163.

Riffle

He has been in constant touch with projectionists and is a registered professional engineer. He left Motiograph to enter his own business, Riffle Electronics Company. His return to the Motion Picture field is most welcome since it is his first love and being in the electronics service field was too far removed from the cinema world.

As an advisor to Lorraine Carbon Co., he will aid in setting up a Technical Information Service which will be available to all projectionists and exhibitors. (See page 18 for a description of the Free Projection Service Plan.)

New Screen For Cinerama

MINNEAPOLIS — Century theater recently completed installation of a new type of screen to reintroduce Cinerama projection with opening of "This Is Cinerama" — the original Cinerama production which opened the theater six years ago.

Three-booth projection is used again for Cinerama after a break of single-booth wide-screen projection for a Todd-AO production.

The old Cinerama screen had a center panel of solid material and side panels of laminated, or louvred strips. They were angled to eliminate glare from the three projectors which in synchronization show matching sections of the picture.

The new screen is entirely of laminated material with 1,400 strips making up the curve of the screen. Each strip is angled to provide even illumination from each of the projectors to every seat.

"This Is Cinerama" ran more than a year after its introduction six years ago and set a new long-run record for film productions in Minneapolis.

New Book Tells History Of Films

Those who mentally date the start of motion pictures at April 23, 1896, in Koster & Bial's Music Hall on 34th street, New York, will be surprised to learn that magic lantern pictures were screened in Rome about 1645.

These pictures did not move, but they were magnified with lenses and they satisfied what seems to have been a universal longing to reproduce life in picture form. The Chinese had shadow pictures more than 5,000 years ago.

These little known facts are traced step by step in a new book called "Magic Shadows" by Martin Quigley, Jr. It is extremely interesting reading—for projectionists, for teachers dealing with motion picture subjects, and for those with a natural curiosity about generations of scientists whose work finally culminated in the use of plastics as film with light from an electric arc for illumination.

Present day films are the result of hundreds of years of study of the human eye, persistence of vision, color, and, importantly, dreams. The book is interestingly written in non-technical English.

"Magic Shadows, the Story of the Origin of Motion Pictures," by Martin Quigley, Jr., Quigley Publishing Co., New York City.—J.M.J.

New AV Catalog From Genarco Inc.

JAMAICA, N. Y.—Genarco Inc., 97-04 Sutphin Boulevard, manufacturers of spotlights, searchlights, and 3,000 watt slide projectors, has issued a new Audio-Visual equipment catalog.

The new catalog describes several new models in the Genarco line of slide projectors used for industrial shows, very large auditoriums, projection of giant images indoors and outdoors for advertising. The new models project 6,000 lumens on the screen where previous models projected only 4,000 lumens using the same 3,000 watt lamp.

MRIA DIRECTOR

CHICAGO—Daniel E. Denham, Minnesota Mining and Manufacturing Co. executive, has been named a member of the board of directors of the Magnetic Recording Industry Association.

General sales manager of the Magnetic Products Division of 3M, Denham joins the MRIA Board of Directors at a time when membership has grown to forty-six member companies.

LETTERS TO THE EDITOR

Non-Intermittent Projectors and Strobe Lamps: Well, Why Not?

Editor, IP:

I enjoy reading IP to get the real facts behind all the ballyhoo that accompanies many of the new processes and units of equipment. But something bothers me. Intermittent projection and carbon-arc lamps seem archaic in a technological age when the launching of space satellites has become commonplace. Here's what I mean:

1. **Intermittent projection.** Mechanically starting and stopping the film 24 times per second is hard on film and machinery, not to say downright old-fashioned. Is some group holding up the development of continuous machines (like the Eastman-GE CMP 350 or similar ones) for theatre use? Even with the loss of light such a machine entails, it would seem that present-day light sources might make somewhat similar mechanisms feasible for the smaller theatres. Among the many advantages, think of the smoothness!

2. **Arclamps.** Oh, these trouble-causing, heat-producing, film-damaging behemoths! The Philips strobe-type lamp is a step in the right direction. I understand it is very satisfactory for smaller houses. Why isn't the American equipment industry developing a "cool" light source big enough for the largest screens? Besides the Philips approach, there is the new optical maser that offers a possible source of "cool" light — at least far cooler than that of the carbon-arc lamp.

C. R. WEBB
Sugar Land, Texas

Technical Editor's Comment:

Recent issues of IP (December 1959, May 1960) have included detailed and authoritative articles on non-intermittent projectors for theatres. Still later issues have, and will, contain letters and shorter contributions from well-known designers of projectors of this type, as well as from projectionists who have actually operated them. On the whole we can say that the basic theory of non-intermittent projectors for theatres is much more attractive than the actual performance of these machines. Their maintenance and adjustment is a headache; and nearly all of them are wasteful of light.

Twentieth Century-Fox and other producing companies have exhaustively examined the whole subject of non-intermittent projection and have come to the conclusion that the standard intermittent type of projector is the only practical machine for theatres.

Conditions in television film playback are vastly different from those prevailing in large-screen theatre projection. Light is no problem in TV, hence the use of incandescent bulbs, diffusing discs to minimize the effects of scratches in the film, and optical systems which are very inefficient lightwise. Neither the 35-mm Mechau used in the TV studios of the BBC, London, nor the GE CMP 350 offered to American TV broadcasters for 16-mm use would be suitable for theatre projection. Practically all continuous projectors (including these two and the new Jackson mechanism described in the May IP) involve rotating and oscillating mirrors and complicated optics which are light-wasting and extremely difficult to service. Deterioration and maladjustment of the mirrors introduce image blur and flicker.

As a matter of fact, the continuous-motion flying-spot film scanner preferred by many TV engineers does not even form an image. A short-decay cathode-ray-tube raster is focused on the film, and the modulated light passes to a photoelectric cell which has a more linear transfer characteristic than a vidicon camera tube. Such a scanner designed for 3-color separation has been described by Holman, Newton, and Quinn in the **Journal of the SMPTE,** March 1959.

Though undeniably a behemoth in physical size and power, the high-intensity mirror arclamp still remains head and shoulder above all other known projection light sources for optical efficiency and sheer volume of usable light. Nothing yet developed even remotely compares with the crater of the HI positive carbon for light-giving power. No other light source designed for projection is as economical to operate as the carbon arc. No other light source is less hot on the film, **lumen for lumen,** than the HI carbon-arc lamp fitted with a dichroic reflector or heat filter.

Adequate Illumination

Most important of all, only the HI carbon arc is **bright enough** to illuminate adequately large indoor screens and the truly gigantic screens of drive-ins. And carbon-arc illumination is **pure white** in color, of smooth spectral characteristics which give the best results with color films, while the light of incandescent lamps is yellowish and that of xenon bulbs is bluish and harsh.

Xenon gas-discharge lamps are widely used in small European theatres to replace old-fashioned low-intensity carbon arcs. The xenon light source, however, is diffuse and comparatively inefficient from an optical point of view. It requires the use of "honeycomb-condenser" lenses which waste some of the light. The bulbs are cheap to operate, but are expensive to replace. Although xenon illumination is not so heat-producing as either incandescent tungsten lamps or low-intensity arcs, it is hotter, lumen for lumen, than the high-intensity carbon arc. Much of the heat is due to a broad spectral peak in the "black-heat" infrared region, hence heat filters are desirable with xenon bulbs.

Illumination engineers of the Soviet Union are working toward the production of more efficient, high-powered xenon lamps suitable for larger theatres. The most powerful xenon projection bulbs now produced in Germany and England are suitable for pictures no wider than 20 or 30 feet. At least one American equipment manufacturer is actively experimenting with xenon lamps for motion-picture projection; and it is possible that you will see an American xenon lamphouse within the next few years.

Flickerless Pictures

The Philips FP 20-S shutterless projector having a pulsed xenon lamp and a 5-to-1 intermittent for 72 light pulses per second is a remarkable machine, and gives perfectly flickerless pictures on screens of small size. Unfortunately, pulsed xenon lamps are very short-lived, requiring a quick-change system in the lamphouse and, of course, the expense of frequent bulb replacements. It is unfortunate that these lamps do not last long in intermittent service, but this sad fact is well known to all projection engineers. (See "The Xenon Short-Arc Lamp in Motion-Picture Projection" by Seeger, Jaedicke, and Macbeth in the **Journal of the SMPTE,** July 1960, p. 475, col. 2.) Until a new type of pulsed lamp can be devised, this type of projector is impractical for the average small theatre.

It is the opinion of IP that, in the present state of projection technology, the intermittent projector fitted with a cold-mirror high-intensity carbon-arc lamp remains by far the most efficient and practical device for the direct projection of motion pictures on theatre-size screens.

Letters . . .

Editor, IP:

As I recall, Brother J. G. Jackson of Port Alberni, B. C., inquired about the method employed for keeping the arclamp "spot" focused upon the aperture of the Mechau non-intermittent projector. [The writer of this letter, as is well known to readers of IP, is one of the very few American projectionists who have had extensive operating experience on the German Mechau.—ED.]

First, the point where the arclamp beam comes to a focus is at the lower mirror (45° angle). This causes the spot to be oval instead of perfectly circular. The beam then passes through a lens to another mirror from which it is reflected to the aperture without any physical change. The rotating lower mirrors produce the effect of a "flying spot" which follows the frames in the aperture.

It was necessary to use a dead-black masking around the screen, and also to keep the lamp in focus, otherwise you would have part of one frame above the screen and also part of one below the screen in addition to the picture on the screen.

DICK BARTEL
San Francisco, Calif.

National Carbon Has Exhibit At TOA Convention

LOS ANGELES—Motion picture exhibitors from throughout the nation gathered near the movie capital of the world for the annual convention and trade show of the Theatre Owners of America. They should have felt right at home in a new exhibit designed especially for the show by National Carbon Company, Division of Union Carbide Corporation.

Dominated by a blinking-light marquee that read "Your Patrons Deserve Five-Star Screen Light," the exhibit in booths 50 and 52 displayed National Carbon's line of projector carbons designed to give the best possible screen illumination, thus providing maximum movie enjoyment. Twin billboards publicized National Carbon's "double-feature" of product and service, and carried out the company's theme of selling the best product and giving the best service.

On hand to discuss screen lighting with theatre owners attending the convention were the following National Carbon personnel: W. T. Brenner, J. W. Cosby, P. H. Freeman, C. W. Handley, J. B. Hoynes, W. C. McCosh, S. Morley, Jr., and V. J. Nolan.

Magnetic Stabilization Of the Arc

Reprinted from the Showman, May 1960

BY DOUG HARLEY

AUCKLAND—A vital part of every high intensity arc lamp is the built-in magnetic control used to stabilize the burning arc. The use of a magnet of either the permanent or electro magnetic type ensures that the luminous salts in the carbon core are evaporated correctly and the pure white ball of gas is properly formed and held in the crater of the positive carbon.

Over the years manufacturers have incorporated various types of magnets in their lamps and it is interesting to note the similarity between American and European practice.

The major American arc lamp manufacturers have produced a few changes over the years — the most notable being the introduction of a new permanent alnico magnet for use in the Peerless Magnarc. For many years Peerless settled for a large U type permanent magnet placed low down behind the mirror. Over long periods of operation this magnet gave excellent results and superb control at the crater. Peerless lamps with this magnet have been in use for as long as 20 years, and the magnetic flux was still satisfactory.

Adjustable Magnet

However, a fixed magnet has certain disadvantages and the Peerless factory in 1948 came up with a new type round Alnico magnet which was capable of being moved towards or away from the burning arc. It could also be adjusted from right to left or vice versa, thus giving the projectionist complete control of the arc. Most important the tailflame could be centered straight up, thus doing away with sideways burning of the crater.

Some years ago the writer came across a Magnarc which persisted in burning a crooked crater. Examination showed that the tailflame was definitely pushed over to the right. As this model had the old type fixed magnet it was not possible to remedy the defect without major alterations to the magnet.

The new Peerless magnet was also re-positioned above the arc, but still behind the mirror, a position favored by the Ashcraft people. Projectionists operating Peerless lamps equipped with this new magnet (the English Magnarcs have them) should read very carefully the instructions supplied for positioning the magnet, and if their arc is not burning correctly, the trouble can usually be overcome by altering the position of this magnet.

It is interesting to note that the Italian Victoria X arc lamp is equipped with exactly the same magnet as the Magnarc.

The Ashcraft lamps for many years incorporated an electro magnet high up behind the mirror. It was a true electro magnet — a soft iron rod surrounded by many turns of fine wire and connected across the arc lamp voltage. Naturally, as the voltage varied or the carbon trim was altered the magnet automatically increased or decreased its flux. This magnetic control was very satisfactory although some projectionists found they obtained better control of the arc if they lowered the entire magnet down about two inches.

Immediately after the war Ashcraft started to equip their lamps with a simple wire hoop which was placed over the positive carbon guide. The positive carbon moved between the ends of the loop and the passage of current through the carbon energized the metal setting up a magnetic flux. This simple device worked quite well but was nothing new — only a smaller version of the larger metal loops used by the Zeiss Ikon factory in their pre-war H.I. lamps.

The new Zeiss lamps, like the British G.K. models, incorporate a very simple magnet — a length of soft iron rod around which is wound a length of one of the arc lamp leads. Zeiss place their magnet low down behind the mirror, and also use the same position on certain of their models. On others they place the iron above the mirror. Either position appears to work equally well.

Sample Arc Images

The various carbon manufacturers have gone to much trouble in providing booklets which depict every type of arc burning under proper control, and these useful photographs should be in every projection room.

If the projectionist suspects that his lamps are not burning correctly, he should compare the image of the arc with that supplied by the makers of the carbons. Any big variation noticed could be due to some malfunctioning of the arc stabilizing magnet, and intelligent adjustment will usually pay handsome dividends in better overall screen illumination.

Pinhole Plate Method of Optical Alignment

By E. B. HEYER

of Heyer-Shultz, Inc. Manufacturers of Hayer-Schultz Precision Metal Reflectors and H-S Optical Alignment Test Plates.

If top notch projection is desired, optical alignment is a must. And we don't mean just good alignment—we mean dead true alignment. Misalignment, no matter how slight, will effect the amount of light and the light distribution on the screen, the color of the light and the focusing range of the reflector.

100% optical alignment of motion picture projection equipment can be achieved only by optical means. Mechanical methods come close, but have their limitations in that the numerous parts involved can become knocked out of true by careless handling. In addition, any horizontal, mechanical suspension sags to some extent, due to its own weight.

Light rays do not sag when projected horizontally. And the lamp to be aligned is all set up ready to deliver the necessary light rays for alignment purposes. All that is required is a short strip of metal with a pin hole drilled for dead center of the film aperture. This strip of metal should be just under film width so as to fit into the film track where the film would ordinarily ride, and closing the gate on it holds it in place.

With the lamphouse on one side of the aperture and the projection lens on the other side, the test plate at the film aperture becomes the fulcrum point of a light beam lever. The slightest movement of the arc, reflector or entire lamp as well as of the lens would be indicated at the point of aerial image, a short distance in front of the lens.

The aerial image is a picture of the reflector, made by the pin hole plate which, in conjunction with the lens, acts as a pin hole camera. By holding a card in front of the lens this picture may be easily checked for optical alignment. Misalignment shows up as shadow areas in the picture whereas true alignment shows a clearly illuminated reflector image.

With this image to check by, the arc, reflector and lamp adjustments may be made while the arc is burning and the projector running. Even projection lenses have been found to be out of alignment due to improper installation, as well as variations between projection head and lamphouse base mounting positions.

When optical alignment is completed and a clearly illuminated reflector aerial image is obtained, the arc indicator card is then reset or remarked to suit and the lamp is in perfect focus at the film aperture.

The pin hole plate method of optical alignment is so precise and infallible that one of the more prominent manufacturers of carbons has incorporated this principle into their engineer's service kit, by including H-S Optical Alignment Test Plates as a part of the required equipment.

New Product May Aid Reconditioning Of Theatre Seats

BROOKLYN, N. Y. — Plasticover, Inc. is now manufacturing a new product called Liquid Leatherette. It is being distributed nationally in the Marine Industry and distribution will start shortly in the Paint and Hardware trade. Theatre Equipment Supply dealers have been selected to distribute this product in the theatre industry.

The new product is packaged in 9 colors in a full 16 oz. aerosol can which will cover approximately 30 square feet and which is so easy to use that any amateur can coat leatherette like a professional.

It will renew and recolor any vinyl leatherette furniture such as theatre seats, lounge furniture, plastic wall coverings, etc. It will dry in ten minutes and can be subjected to severe flexing without damage in thirty minutes. It will not crack, chip or peel, is completely washable and has all of the characteristics and qualities of the finest virgin vinyl.

Liquid Leatherette

Address your orders and correspondence to PLASTICOVER, INC., 63 Seabring Street, Brooklyn 31, New York.

Plea for American Equipment Sounded By TESMA President At TOA Convention

LOS ANGELES — A plea that exhibitors support the American equipment industry rather than shop for foreign equipment was made at the TOA convention by Larry Davee, Century Projector Corp., New York, and new president of the Theatre Equipment and Supply Manufacturers Association.

Speaking at a forum on equipment and its maintenance, the president of Century said that "unless we in this industry suport the U. S. manufacturers there is no incentive to manufacture new equipment and to make motion pictures."

Davee said that the serious thing about the equipment business is that those in the motion picture industry are not cooperating as they should with the equipment people. As a result, he held, there is little incentive today for the manufacturers to develop new equipment.

The TESMA president asserted that "we should look forward to getting together" to the end of encouraging the development of new and improved equipment. He said the equipment industry wants to help in bringing this about.

Mr. Davee suggested that the purchase of foreign equipment in many cases is false economy.

"Many things from abroad are copies of what has been developed in the United States," he said.

He asked exhibitors to "back up the industry with good equipment. We must get those who mould our industry to put on a better show. The tools are available if they can be used correctly. We have a most wonderful opportunity to get down to earth and face fact."

It was Davee's contention that today "too many theatres" are being operated with "obsolete equipment."

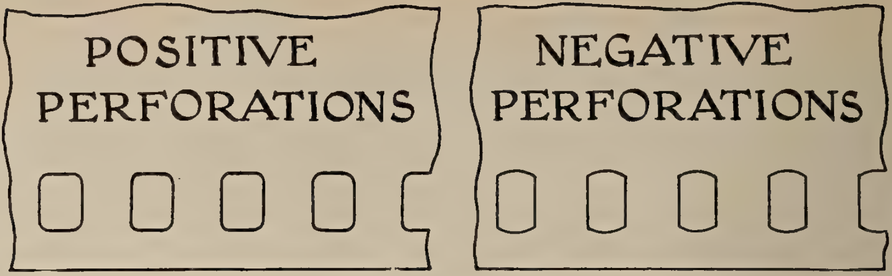
'What we are doing today falls short of what we ought to do," he maintained.

Davee said that "some theatres are not putting on the best possible show," because of the failure to pay proper attention to equipment. It is necessary that theatres "have the best quality sound equipment they can get." — The kind that the theatre patron is not made too conscious of was viewed by Davee as "the best type of sound."

"If you can put the least distracting sound in the theatre you can have a better show," he counseled.

From another panelist, W. J. Cosby,

(Continued on Page 19)



Perforations in 35-mm Film

Know your film perforations? If not this short description will keep you abreast of Sprocket-hold savvy.

WHEN CECIL B. DEMILLE began production in 1913 on his first Hollywood feature film, "The Squaw Man," he purchased an English-made film-perforating machine at a bargain price. It did a beautiful job (DeMille thought) of punching sprocket holes in the movie film.

In those days 35-mm film usually came in rolls of unperforated raw stock. It was up to each producer to punch out his own sprocket holes. The processing laboratories did the same to the positive print stock. Needless to say, a bewildering variety of perforation sizes, shapes, and "pitches" prevailed; and cameras and projectors often "jammed" on the odd ones. When a projectionist heard the film buzz and crackle on the sprockets of his machine, he said (after a few appropriate words of profanity), "Now, I wonder who made **that** print!"

A weird thing happened when DeMille projected a print of his premiere feature for the first time. The pictures kept rolling up and off the screen in dizzy procession! DeMille was nonplussed. He took his film to the old Lubin laboratory, half expecting to be turned away, inasmuch as Lubin processed film for the old producers' combine, and DeMille was an "independent." But a Lubin technician inspected the film and quickly ascertained the trouble: DeMille's "bargain" film perforator punched sprocket holes at an odd pitch employed by some unknown individualist in Merrie England!

Blank film was cemented to the perforation margins of DeMille's ailing negative, and new sprocket holes were punched out at the old standard pitch of 0.1875 inch from the pulldown edge of one sprocket hole to the pulldown edge of the next. Thus "The Squaw Man" was saved, and DeMille's first film triumph reached the screens of the old-time nickelodeons and "picture halls," where it was a tremendous success.

Believe it or not, several different 35-mm perforation standards still prevail, even though the perforation-punching is now done on the film manufacturer's precision machines. Fortunately, each type of perforation is very accurately standardized; and all of them, negative-type and positive-type, will run satisfactorily in any standard 35-mm projector. The only exception is the small CinemaScope type of perforation used for 35-mm magnetic-track prints. These prints require special small-tooth sprockets. Most theatres are equipped with them, else 20th Century-Fox would soon go out business!

The two principal types of film perforation are the negative and positive. The negative type, known as the Bell & Howell perforation, is preferred for many cameras and printing machines because, with properly shaped registration pins and sprocket teeth, it permits the most accurate registration of the frames and eliminates picture jump.

Practically all theatre-release prints were made with BH perforations from the earliest days of the art to the middle 'twenties. And more than eighty per cent of all prints were made on tinted stock in those days — blue for night scenes, violet for mysteries, rose-pink for romantic bedroom scenes, green for sagas of the sea, bright yellow for comedies (slapstick, of course!), and various shades of amber-orange for nearly all other footage. The color was

emotionally suggestive and made the silent "flickers" easier on the eyes. And the silver picture-images were sometimes toned — green on yellow stock, violet on pink stock, blue on clear stock, etc. — to add even more beauty to the screen in the years before Technicolor.

The problem of accurate image-registration in duplicating natural-color films and making the prints is so very critical that BH perforations were used by Technicolor, Cinecolor, etc., up until about ten years ago. Unfortunately, negative perforations with curved sides have sharp corners from which cracks or tears readily start, and hence do not hold up under the conditions of projection use as well as the rectangular, straight-sided perforations having rounded corners. Negative-perforation prints have been practically non-existent since the general inception of safety film in the early 1950's.

With but one exception, the perforation distance, or "pitch," is uniformly 0.1870 inch for all the different 35-mm perforations in use today, negative and positive. The exception is "short-pitch" negative having BH perforations. The short pitch distance of 0.1866 in. is intended to accommodate printers made for contact-printing shrunken nitrate negatives with a minimum of slippage between the negative and the unshrunken positive raw stock. Thus 35-mm camera and duplicating negative stock may be ordered with regular-pitch or short-pitch BH perforations.

Many cameras and printers, as well as most color-film printing machines, accept the Dubray-Howell perforation, which is a sort of "combination" negative-positive perforation. It is rectangular in shape, but not quite as high as the regular positive perforation. Moreover, even though its corners are rounded, the radius of the fillet is so small that the corners of DH perforations look practically square.

DH perforations are used mostly for certain kinds of color negative, intermediate, and positive films, such as Eastman Color. There is some evidence that both DH and the small CinemaScope-type (CS) perforations crack more readily at their corners than regular positive perforations.

The regular release-positive perforation now used universally is known as the Kodak Standard perforation. The relatively long radius of the fillets, or rounded corners of KS sprocket holes greatly minimizes cracking at the corners and increases the useful life of the prints. Both black-and-white and Technicolor prints have KS perforations.

The small CinemaScope perforations have rather sharp corners, as do DH color-film perforations, and hence are apt to crack at the corners after long use. These CS sprocket holes are now used only for the so-called "magoptical" prints carrying four magnetic soundtracks and a reduced-width optical track on the same film. The popularity of this type of print waned with less use of stereophonic magnetic sound in theatres, but, as stated previously, most American theatres can play these small-hole prints. In the great majority of

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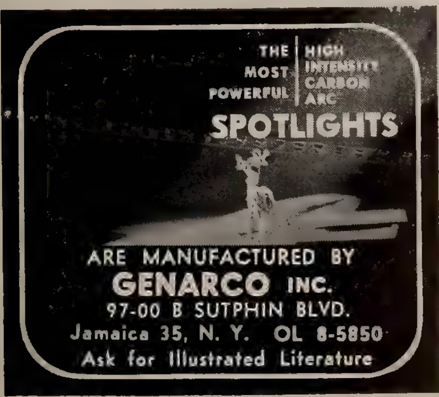


Lorraine Carbons' Projection Service Plan

The use of new high powered lighting equipment to illuminate the larger screens has increased the need for improved installation and maintenance techniques in the projection room.

Realizing that few theatres have the trained personnel or specialized test equipment necessary to keep such equipment operating at maximum efficiency, Carbons, Inc., distributors of Lorraine Carbons, has for some time offered a projection check-up service to any theatre requesting it. The demand for this service has been rising steadily, indicating that it is doing a worthwhile job and requiring an expanding technical staff.

This service includes a check into the primary power source, which if not properly used or if it is subject to one or more common troubles, will cause unsatisfactory performance of the generator, rectifiers or lamps. The power company may supply either a 208 or 220 volt three phase service (both are standard) which may or may not have sufficient capacity or voltage regulation characteristics. Improperly matched equipment or poor voltage regulation is a major cause of poor projection. In many cases the power company will cooperate in making changes if the need can be pointed out to them.

These inspections, always made in company with the regular operators, can also reveal such difficulties as overloaded generators or rectifiers, improper operation of ballast resistors, defective switches and cables or inaccurate meters.

As the main object of the inspection is to improve the screen lighting the main effort is concentrated in this direction. In addition to the Karl Freund Spectra meter and Luckeish-Taylor meter, each Lorraine man si equipped with a Panavision Brightness meter developed by the Motion Picture Research Council whcih gives standard brightness readings.

This meter has a special adapter for checking drive-in screens. This has been a problem in the past due to the relatively lower light values involved. The 1 to 30 foot lambert scale (recommended indoor screen brightness is 10 foot lamberts plus 4 and minus one) is converted to a 1 to 6 FL scale. This is of great importance as few drive-ins exceed a value of 3 FL. Standard procedures are used in recording incident light and distribution. Special care is also directed to ambient lighting as this can degrade the picture. Lamphouses are checked as far as vibration, misalignment, carbon feed equipment, draft and economy of operation is concerned.

Alignment procedures as recommended by the manufacturers are performed using special tools. Air flow through lamps and heat at aperture can also be checked. Special meters make it possible to record volt and ampere readings without interfering with the operation.

A recent survey showed that 57 per cent of the drive-ins checked have a screen brightness of less than 3 FL and in only 5 per cent were brightness levels of more than 5 FL measured. It is believed that this record can be greatly improved without the addition of any new equipment.

The proper use of the right carbon combination continues to be the main area where lighting improvements can be made.

A 28 minute film which shows how projector carbons are made and some of their uses is available. Arrangements can be made to show the film to interested groups, especially exhibitors and projectionist organizations. The first part of the film is in black and white and shows the manufacturing processes. The second part, by means of a cartoon and live action in color shows the carbon arc in operation. The importance of proper mirror alignment is also demonstrated.

ANSCO MICRODENSIOMETER

BINGHAMTON, N.Y.—Ansco, the photographic manufacturing division of General Aniline & Film Corporation, has just announced the new Ansco Automatic Recording Microdensitometer which is designed to meet the exacting demands of modern microtechnology.

The Ansco Microdensitometer was developed for measuring and recording with extreme accuracy transmission and reflection densities of micro images in the field of photography and the graphic arts where critical measurements of acutance, granularity, resolution, and related studies are essential to the evaluation of image quality.

Although originally designed for specialized photographic application, the instrument is now being used in various diversified fields where extremely accurate measurement of optical image characteristics is required.

TOA CONVENTION

. . . Continued from Page 15

sales manager of arch carbon products for National Carbon Corp., came the advice to theatre men "to give the best possible show" holding that the theatre patron "deserves good screen light." He warned against 'bargains" in the purchase of carbons.

Cosby said "theatre men should figure the cost of carbons by the reel rather than by the case."

The National Carbon executive said preference should be given to "the larger lamp house with the larger carbon" by exhibitors considering the purchase of new equipment. "It'll give you more mileage", he said.

The importance of maintenance of equipment was stressed by J. Walter Bantau, general purchasing agent and chief engineer of National Theatre Amusement Co.

"Much of our equipment is lost through poor maintenance," he stated.

The theatre men were told that they should consider the installation of new screens "as soon as possible."

Bantau reminded the exhibitors not to overlook utilities in checking their equipment. He urged that theatre owners encourage their operational personnel to report the conditions of equipment.

Hal Neides, purchasing agent for the Blumenfeld Theatres of San Francisco, chairmaned the session.

FILM PERFORATION

. . . Continued from Page 17

cases, only the optical track, even though inferior because of its reduced width, is used.

BH (negative), DH (negative and positive color), and KS (regular positive) perforations are placed so that their outer sides are 0.079 in. from the edge of the film. CS (small CinemaScope) perforations, on the other hand, are 0.086 in. from the edge of the film. The pitch of all these perforations is uniformly 0.1870 in. except, as previously noted, the 0.1866-in. short-pitch negative perforations.

The dimensions of these 35-mm film perforations are as follows:

1. **Bell & Howell negative perforation.** Curved sides and sharp corners. Maximum width = 0.110″, height = 0.073″.

2. **Dubray-Howell negative and positive perforation.** (For certain types of color-process films.) Rectangular, rounded corners. Width = 0.110″, height = 0.073″, radius of fillets = 0.013″.

3. **Kodak Standard positive perforation.** Rectangular rounded corners. Width = 0.110″, height = 0.078″, radius of fillets = 0.020″.

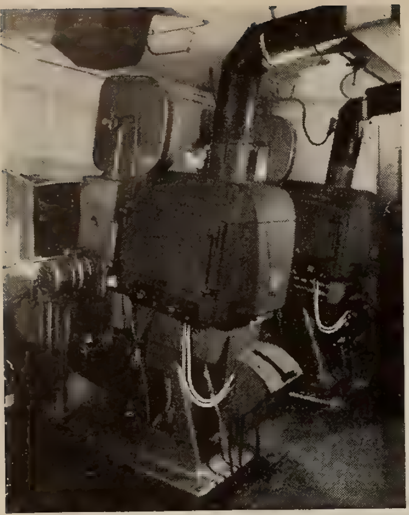
4. **CinemaScope magnetic-sound positive perforation.** Rectangular, rounded corners. Width = 0.078″, height = 0.073″, radius of fillets = 0.013″.

It is interesting to note that Soviet motion-picture technicians have long advocated the adoption of a single standard type of perforation for all kinds of 35-mm film, negative, positive, black-and-white, and color. This seems to be a common-sense proposal, and might well be adopted by equipment manufacturers in all countries.

REEVES MERGER

NEW YORK—Reeves Broadcasting and Development Corp. and Reeves Products, Inc., has been merged to form Reeves Sound Studios, a division of Reeves Broadcasting and Development Corp., states Hazard E. Reeves, president.

New recording studios will be completed shortly. The new equipment will permit "mixing," or re-recording of several video tapes into a composite master tape, from which copies can be made for television release. It will be possible to integrate 16mm or 35mm pictures, black and white or color.



70 MM DRIVE-IN—Shown is the installation of National 70 Bauer projectors and 1960 Model Constellation arc lamps recently installed by National Theatre Supply at the Rancho Drive-In, San Diego, California, for the projection of 70 mm film productions.

SHUTTER DESIGN

. . . Continued from Page 6

and the mechanism cooling plate. This, together with the circular light-beam hole in the shutter case, can pass the beams from f/2.5 and f/2.3 lamps without obstruction, but interferes with the wider beams from faster lamps. The same applies to the rear component of the Simplex E-7 front-and-rear shutter.

Evolution of Simplex

It should be noted that the Super Simplex is merely a Regular mechanism with a few refinements, especially in the shutter, which has been moved to the rear of the machine, and in the lens-holder and micrometer focusing device. Also, the E-7 is built on the same general plan as the Super, although containing a number of notable mechanical improvements the Super doesn't have.

Just as the Super Simplex rear shutter, together with the sight box, threading light, and framing adjustment with knobs, has been adapted to existing Simplex Regular heads, the E-7 type of front-and-rear double shutter has been adapted to both the Super and Regular mechanisms. It is thus possible to modernize somewhat the older Simplex projectors.

Nevertheless, of the Simplex projectors only the X-L may be regarded as a new departure instead of an improved version of its predecessors, which can be easily traced, through identical characteristics of structure, all the way back to Projectionist F. B. Cannock's Edengraph of 1899.

The conical-shutter Simplex X-L was introduced in January 1950; and at that time, the hole in the rear cover of the shutter housing and the openings in the two heat shields were plenty large enough to admit all of the wide beam from an f/1.9 lamp without hindrance. With the later use of the more powerful f/1.7 arclamp, however, a larger hole in the rear cover of the shutter enclosure became necessary. With this simple change, the X-L mechanism is capable of accepting light beams up to about f/1.5 in speed, and the full advantages of the f/1.6-f/1.5 projection-lens holder may be realized.

Motiograph Also Improved

The Motiograph with its cylindrical shutter and associated housing and heat baffles was sometimes criticized by arclamp manufacturers as blocking substantial portions of light beams wider than those obtained from the older f/2.5 and f/2.3 low-intensity and simplified high-intensity mirror lamps. Such criticisms of the H, HU, and K were justified.

The barrel shutter, itself, as well as the heat baffles employed in Motiograph mechanisms up to and including the Model K, cut too far into the light beams from the newer, faster arclamps. In this respect, these older Motiographs are in the same boat with Simplex Regular, Super, and E-7 mechanisms.

Only those American projectors produced within the last three years (not including the Wenzel and RCA Brenkert) have been built without small-holed heat baffles and extraneous metal protuberances. This includes the Simplex X-L and the Motiograph AAA.

The Motiograph has not only eliminated all baffles, but has widened the shutter opening one-half inch by using wider barrel shutters. The aluminum template which represents the light from the arc will go through the new shutter 1⅞ inch farther than it will with the old-type shutters. This indicates that maximum illumination is being delivered to the aperture from the large mirrors of fast lamps. The shutters for the Motiograph AA and AAA are still supplied in four blade widths for various needs.

Film Cooling A-1 Problem

It follows that if heat baffles are eliminated in any mechanism, something must be done to eliminate the excess heat. Air-cooling of the aperture and film is one method: water-cooling of the entire gate casting is another. All manufacturers of quality projectors employ both.

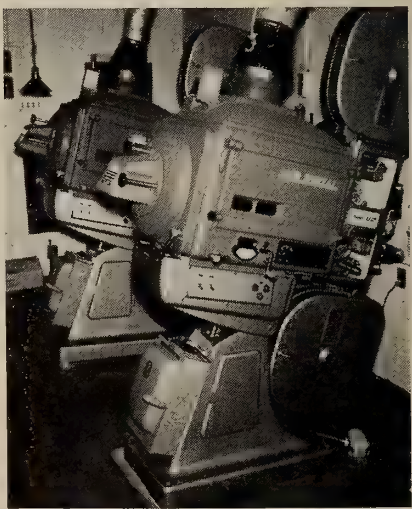
Certain cone shutters available for the Simplex X-L are made with vanes to spray cooling air over the aperture and film; and, of course, water-cooled gates are available for drive-in and large-theatre operation.

The Motiograph AAA also has both air and water cooling. To offset the absence of the heat baffles employed in earlier models, a small rotary fan was added to the governor to assist the air-pumping action of the shutter fins. With the elimination of fins from the new wide shutter rotors, an air-blower was developed to force a large volume of cool air over the aperture region of the water-cooled gate.

It stands to reason that the design of the projector mechanism should keep pace with the recent tremendous advances in arclamp technology if maximum screen illumination without undue heating of the gate assembly and the film is to be obtained. Shutter efficiency is as important as powerful arcs for higher light levels; but even heat filters or "cold" mirrors cannot eliminate all of the heat. By its very nature as pure electromagnetic energy, even visible light is heat-producing. The greater the intensity of the light, the hotter the film will get unless measures are taken to cool both the mechanism and the film. Increased optical efficiency and more effective cooling means thus go hand in hand.

FRED GALLUZZO DIES

CHICAGO — Fred Galluzzo, 4207 N. Francisco Ave., member of Local 110 of the IATSE, passed away here on July 28. Services were held on August 1st at Our Lady of Mercy Church with entombment at Queen of Heaven Cemetery, Hillside, Ill.



70 MM AND 35 MM—Shown is an installation of "35/70 Special" projection arc lamps on National "70" Bauer projectors just completed at the Metropolitan Theatre, Winnipeg, Canada, for the presentation of 70 mm as well as 35 mm film productions.

MONTHLY CHAT

. . . Continued from Page 3

it runs through the projector is very bad practice — messy and injurious to the film. Also, too much oil will vaporize in the gate and fog the lens.

The oiling of green prints is unnecessary when a modern projector such as the Simplex X-L and the Motiograph AA is used. The Simplex E-7 also has a more convenient tension-adjusting device than its predecessors. Modern projectors permit the gate tension to be varied even while the film is running. Only in the case of a most unusual malfunction, such as the one brought to our attention by Brother Griesel, can any damage to the print possibly result.

Eastman Kodak, who probably know more about film than anyone, recommend a gate tension of from 6 to 16 ounces, this being measured by attaching a short length of film to a spring scale and drawing the film slowly upward through the gate. The lightest tension, 6 ounces, is considered sufficient for a steady image with a green print; 9 or 10 ounces is normal for the average print, while old, dried-out films may require the full 16 ounces.

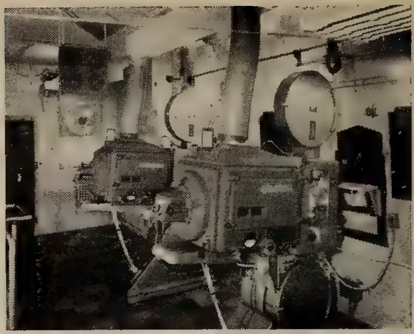
The pressure of the adjustable-tension gate of the Motiograph Models AA and AAA can be varied in three definite steps: 225 grams (8 ounces) for green prints, 375 g (13 oz.) for average prints, and 675 g (24 oz.) for prints which have seen better days and are smeared with oil.

It will be noted from the Eastman recommendations and the actual Motiograph AA adjustable-pressure gate that the pad-tension range for satisfactory projection with all kinds of prints is approximately 1-to-3, beginning with 6, 7, or 8 oz. for unlubricated green prints still moist from the processing machines. To avoid damaging the perforations of brand-new prints, never — **but never** — employ more than 8 oz. of gate tension. Of course, if you are stuck with a pair of old Regulars or Supers, you will have to adjust the springs with your fingers for an average tension in the neighborhood of 10 or 12 oz. and trust to luck. Don't oil the prints unless past unhappy experience indicates that such drastic treatment is the only way out of a difficult situation. (Alas, we know from bitter experience!)

—R. A. M.

PRESTOSEAL GETS AWARD

NEW YORK—Leonard A. Herzig, president of the Prestoseal Manufacturing Corporation of 37-27 33rd street, Long Island City, announced that his company was recently honored with the Government's General Service Agency award in the microfilm field. The award carries with it the authorization to all government agencies which may have use for microfilm or tape splicing equipment to employ the services of Prestoseal when buying such equipment.



MILWAUKEE—Shown is an installation of "Strong 35/70 Special" projection arc lamps on Phillips Norelco projectors just made at the Strand Theatre, Milwaukee, for the presentation of 70 mm productions.

Diamond Carbons Appoints New Sales Engineer

McKEESPORT, PA.—Ringsdorff Carbon Corp. of East McKeesport, Pa., manufacturers of Diamond carbons, announced the appointment of John Cullen, Jr., as sales engineer for the Southern and Midwestern States. Cullen, a member of IATSE, will make his headquarters in Memphis, Tennessee, and can be reached at 959 Barbara Drive in that city.

ABRAMS CELEBRATES GOLDEN ANNIVERSARY

BRONXVILLE, N.Y.—Joe Abrams, retired member of IATSE Local 306 and Local No. 1 of New York, and his wife Mary, celebrated their golden wedding anniversary here.

Abrams' son, Edward, has been a member of Local 306 for over twenty-five years.

AUFHAUSER

. . . Continued from Page 8

merely change the size of a picture after it is projected by the prime lens. We not only do this, but also further correct the image as to contrast and resolution. This, in itself, is quite an achievement because we can now project wide screens with the same basic qualities which we had with four-inch and longer focal length lenses using the Academy frame.

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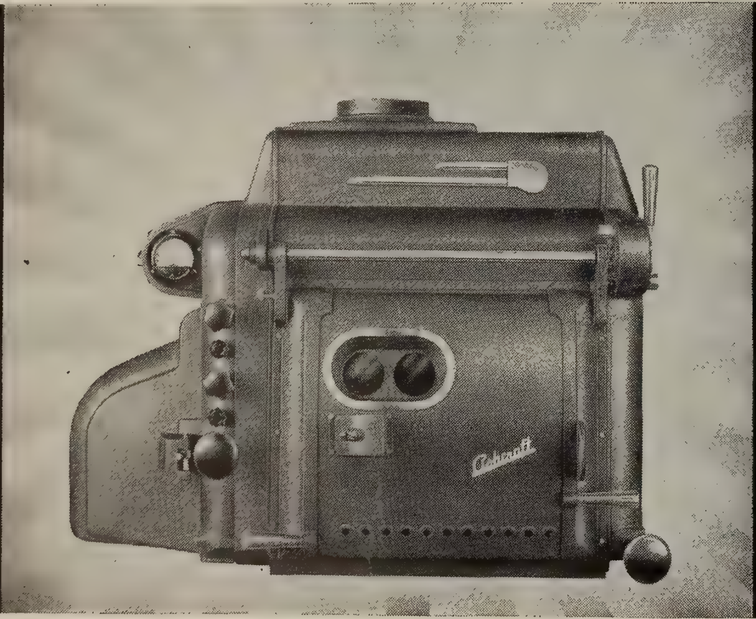

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EAST COAST OFFICE
545 Fifth Avenue
New York 17, N.Y.
Murray Hill 7-7746

RAY GALLO
General Manager

MIDWEST OFFICE
4616 Washburn Avenue South
Minneapolis 10 Minnesota

FRANK W. COOLEY, JR.
Editor and Publisher

R. ENTRACHT
Associate Publisher

RAY GALLO
General Manager

R. A. MITCHELL
Technical Editor

In This Issue . . .

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MONTHLY CHAT

Theatre Projection Is an Art, Not a Mechanical Process!

DOES ANYONE imagine that music lovers would crowd the concert halls to hear the mechanical drumming of a player-piano? Or flock to the art galleries to view a canvas painted by a machine? Of course not! Neither will moviegoers tolerate the absence of showmanship and audiovisual finesse which is so painfully evident when the show is run by unthinking machines — automatic switching devices which eliminate the technical know-how, esthetic discrimination, and experienced judgment of flesh-and-blood projectionists.

Theatre projection is an art practiced by an unseen performer, the showman of the projection room who presides over complex and highly sensitive sight-and-sound apparatus and devotes his tireless attention to its functioning. Can an insensate automatic machine detect a minor malfunction in a unit of equipment and correct it before it develops into a serious and theatre-closing emergency? No! Can a machine judge the quality of screen illumination, detect slight misframes, or tell when the focus needs adjustment? Absolutely not! Only a trained projectionist can impart to the opening and closing of the show, and to the timing of intermissions, **the tempo of showmanship.**

It is neither necessary nor desirable to start and stop a show by the same lights-and-curtains routine every day, for much depends upon the mood of the film and other prevailing circumstances. The projectionist learns during the first matinee or a preview showing which changeovers must be handled with a special technique to avoid clipping off a final spoken syllable or note of music. And unlike an automatic switch which operates from specially cued film, a projectionist can modify his technique and timing on the spur of the moment to obtain some desired effect or to meet any of a number of emergencies.

The projection "automatons" and "robots" extensively marketed in England and Europe are as yet unable to adjust or trim an arclamp, thread a projector with film, or judge the time needed for all members of an audience to find their seats during an intermission. Xenon gas lamps (suitable only for the smallest theatres) assist the robot with their less stringent operating requirements, while the next foreseeable innovation — a house manager, usher, or janitor taught to "thread up" a show consisting of two 6000-foot reels — will hasten the day when theatre movies will be dehumanized into a shambles of sloppy, unprofessional presentation.

"But what about adjusting the focus for various types of prints?" you may ask. "What about the changing requirements of sound volume?"

These two items have been neatly taken care of by "remote-control boxes" already being manufactured in Europe, and which, it may be assumed, will be operated by kids for free tickets, not by projectionists seated in the audience!

Do the changes to CinemaScope and standard prints worry you? Well, the projection automaton automatically handles aperture and lens changes by pre-set signals, takes care of the house lights and curtains, the projector motor and xenon lamp, the sound amplifier, the tape or disc record player, the changeovers, etc. But it has not yet learned how to thread film, take it out of the projectors, inspect it, rewind it, or ship it.

INTERNATIONAL PROJECTIONIST

Volume 35 October 1960 Number 10

Tests and Service Tips for the

Geneva Intermittent Movement

By Robert A. Mitchell, Technical Editor

* The geneva movement, accurate and dependable, deserves loving care. It's the heart of the theatre projector. The magically lifelike illusion which is the goal of the projectionist's art depends upon its perfect functioning.

MANY YEARS AGO every boy owned a toy 35-mm movie projector. Known as the "Keystone Moviegraph," the toy machine had a geneva intermittent with a 5-sided star, a reel-arm which held as much as 200 feet of discarded theatre film, and a household bulb in a lamphouse fitted with a simple bull's-eye lens. There was no take-up; the film (nitrate, of course!) issued from the machine to form an ankle-deep pile on the floor.

The Moviegraph had no shutter, and the intermittent was unbelievably crude even though the essential parts were there. The starwheel was stamped out of brass, and the cam was an iron casting. There was only one film sprocket in the entire machine — the intermittent sprocket — and this consisted of two tin flanges tacked to the ends of a wooden barrel. Needles to say, the picture jumped on the screen like a nervous witch with a hot-foot, and the clatter of the intermittent was deafening. The jump of the image was even more annoying than the top-to-bottom streaks of travel-ghost; and attempts were sometimes made by budding young projectionists to reduce its frightening magnitude.

The picture-jumping was due in great measure to the excessive backlash between the rim of the cam and the curved surfaces of the starwheel. There being no way to adjust these parts, it was found that the backlash could be overcome, after a fashion, by pressing hard against the film with the fingers as it entered the gate, thus applying drag, or tension, to both film and intermittent. The film was severely scratched and the sprocket holes torn, but the pictures were steadier, and the film could be set on fire in the vacant lot for an impromptu pyrotechnics display when it was worn out.

High Tension Bad Practice

What has these childhood reminiscences to do with professional projection practice? Just this: We have encountered a case where picture-jump caused by a maladjustment intermittent movement in a high-quality theatre projector was "cured" by tremendously increasing the tension of the gate tension pads.

In this case, also, the film was damaged — so badly, in fact, that the exchange presented the theatre with a blistering letter of complaint. Now, the methods used by the kids of yesterday to get rocksteady images of Tom Mix and Charlie Chaplin on bedsheet screens are not the methods that grown-up professional projectionists ought to employ. When picture unsteadiness is caused by a malfunctioning intermittent, the only satisfactory remedy is readjustment or repair of the movement.

Your intermittent movements should unfailingly receive careful, intelligent treatment and periodic checkups because they are so important to the success of your work. Nothing less than an absolutely rocksteady picture is acceptable today. Fortunately, a well-made geneva movement is a rugged, trouble-free device which retains its original registration accuracy for many, many years. When adjusted correctly and kept lubricated according to the manufacturer's instructions, it is practically wear-proof.

No other type of intermittent is as serviceable as the geneva for projection machines.

Structure of Geneva Movement

The two essential parts of a geneva movement are the starwheel and the cam with its star-turning pin. The intermittent sprocket is attached to the end of the starwheel shaft, and the flywheel to the end of the cam shaft (except in the case of the Simplex Regular, Super, and E-7 intermittents, which have a separate short flywheel shaft and 1-to-1 gears to drive the cam shaft).

The operation of a geneva intermittent is easy to understand. The pin of the cam engages a starwheel slot, turns the starwheel (and sprocket) a quarter of the way around, and then locks the star as the rim of the cam revolves against

one of the concave curved surfaces of the star. This action is repeated 24 times a second when the projector is run at standard sound speed, the cam (and flywheel) making 24 revolutions per second, and the star (and sprocket) making 6 in the same interval of time. The star and sprocket, however, revolve with a characteristic "stop-and-go" motion which serves to register the film-frames one by one over the aperture, holding each frame motionless for 1/32 of a second.

The conventional 3-to-1 geneva intermittent holds the film motionless for three-fourths of a cam revolution and pulls it down to the next frame during the remaining quarter of the cycle (90 degrees). This "speed" of intermittent action is the result of the geometry of a star-and-cam system designed so that the cam-pin enters the starwheel slots **tangentially** for silent, shock-free action.

Higher intermittent speeds, or pulldown ratios, are obtained by accelerating the speed of the cam during the pulldown and decelerating it the rest of the time. This requries an eccentric cam-driving arrangement, as in the Simplex X-L 5-to-1, or 60-degree, geneva movement.

"Stop-and-go" Characteristics

Among the many desirable features of the geneva movement are the **gradual** acceleration and deceleration of the intermittent sprocket at the beginning and end of the pulldowns. Instead of being violently yanked down from one frame to another, the film begins to move very slowly and gradually picks up speed to a maximum "instantaneous" velocity of 870′ per second at the middle of the pulldown. (The **average** speed of the film remains 90′ per second, of course.) Then the film decelerates and comes to rest with equal gradualness. This kind of intermittent action is ideal, for it inflicts a minimum of wear on the perforations of the film. It also requires a lower gate tension than any other acceleration-deceleration characteristics.

The star and cam of a high-grade geneva movement are both finished to a tolerance of 0.0001″, and are made of hardened tool steel. But even when the parts of an intermittent are accurately made and in perfect condition, the unit may give poor results on account of (1) poor adjustment of the star-and-cam relationship and (2) a worn or lop-sided intermittent spocket.

Sprocket Teeth Important

The bore-hole, circumference, and teeth of an intermittent sprocket must be machined as accurately as the star, the cam, and their respective shafts and bearings if the unit is to give perfectly rocksteady pictures. And even though

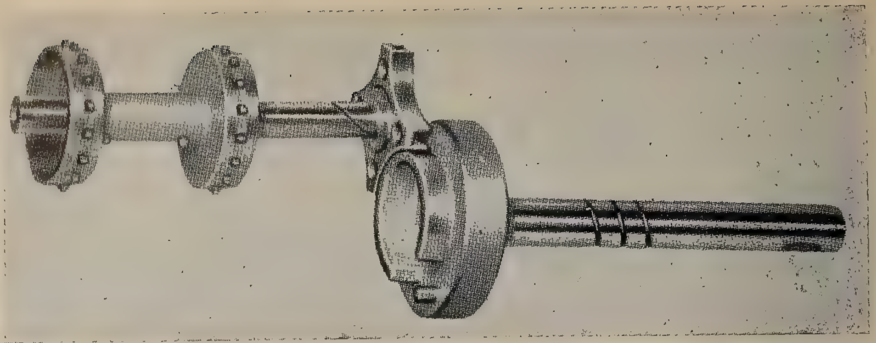

FIG. 1 — Basic parts of a geneva intermittent movement — all makes. The sprocket is attached to the starwheel shaft, and the flywheel (not shown) is attached to the cam shaft either directly (Brenkert, Motiograph, Simplex X-L) or through 1-to-1 pinion gears (Simplex Regular, Super, and E-7).

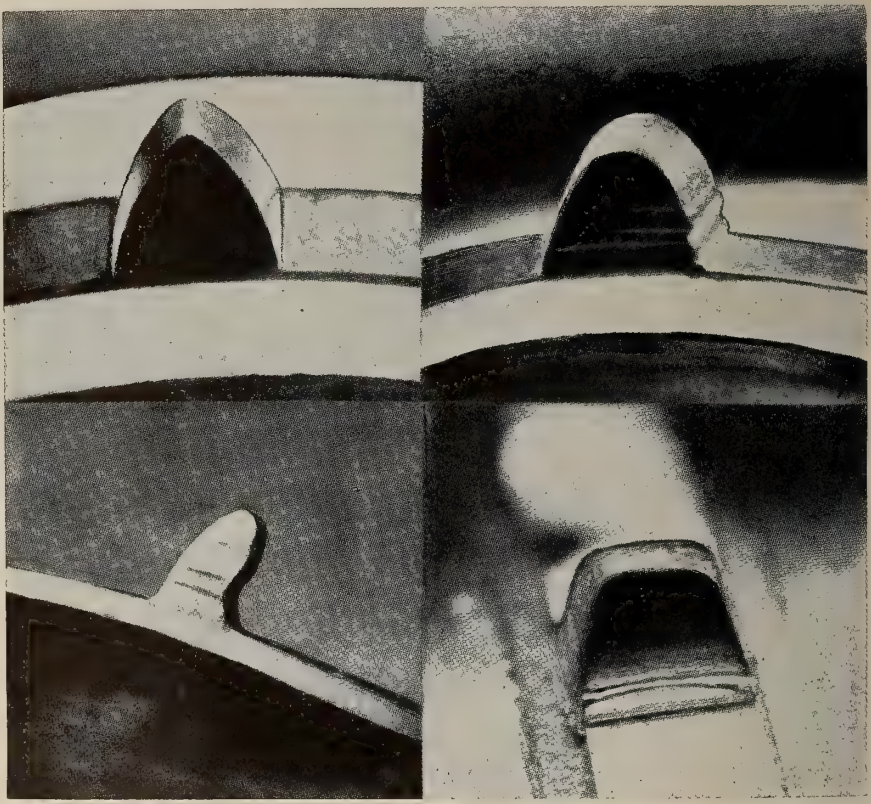

FIG. 2 — The two top photos show a new intermittent-sprocket tooth (left), and the same tooth after it has become notched by the passage of many miles of film. Lower photos show a badly hooked tooth in profile and face-on. Notched and hooked sprocket teeth "sing" noisily and damage the film perforations.

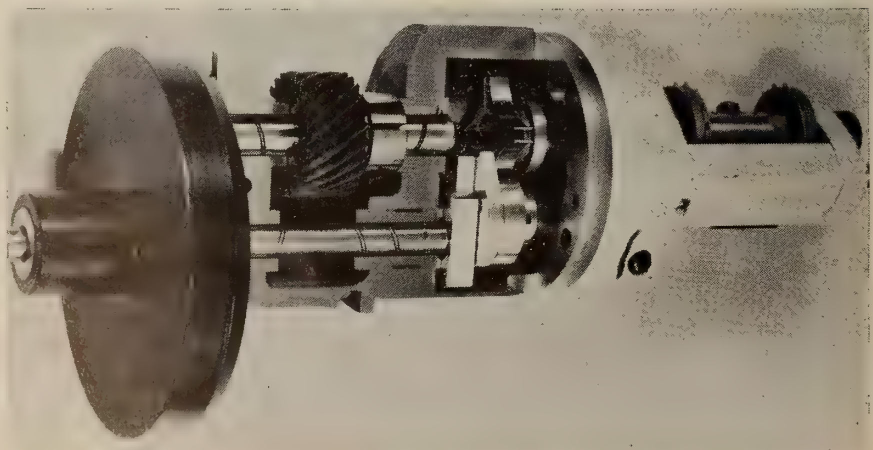

FIG. 3 — Cutaway of a Simplex X-L Hi-Speed intermittent showing the eccentrically driven cam. **Note the heavy construction of the starwheel and its highly polished surfaces. These parts are machined to a tolerance of less than 0.0001 inch!**

starwheels and cams last almost indefinitely, the teeth of the intermittent sprocket are worn down by the film after a year or two. Worn sprocket teeth usually cause picture-unsteadiness and almost invariably chip or tear the film perforations.

For that matter, hardened accumulations of gelatin deposited at the base of the sprocket teeth from "green" prints cause more or less unsteadiness of the projected pictures. This is why the teeth of an intermittent sprocket should be cleaned each day by means of a stiff-bristled toothbrush lightly moistened with kerosene or fuel oil. (And while you're about it, clean the teeth of the soundhead sprocket similarly to avoid "wows" and "whiskers" in the optical sound reproduction!)

Now take out your penknife or jackknife to make a crucial test of the condition of your intermittent-sprocket teeth. If a sharp "click" is heard or felt when the blade of the knife is passed over the pulldown surface of one of the sprocket teeth from its base to its tip, a notch has been worn into the tooth by the passage of many miles of film. An intermittent sprocket having notched or hooked teeth should either be reversed, if this is possible, or else replaced with a brand-new sprocket. Test **both sides** of the teeth with a knife-blade to find out if reversing the sprocket is feasible. When both sides of the teeth are notched, the sprocket is no longer fit for use.

Uneven Wear of Teeth

Projectors in which the entire intermittent movement is rotated around the axis of the starwheel shaft to accomplish the framing operation sometimes reveal wear of the intermittent-sprocket teeth in a peculiar way. Such projectors include all Simplex models, the Brenkert, Wenzel, Kaplan, Century, and Superior. If the framing knob is left in one position for a long period of time, the sprocket teeth may wear irregularly in such a way that picture unsteadiness is produced when the position of the framer is changed, as it must be if a reel of film contains an accidentally misframed splice.

Picture unsteadiness arising from this cause is very characteristic.

The screen image "dances," or jiggles, very rapidly — 6 up-and-down vertical movements per second, or one movement per revolution of the sprocket. Of course, other defects can also cause 6-cycle image dancing; and you should eliminate the possibility of these by noting whether or not there is **one framer position** where the dancing disappears. These other defects include a badly made starwheel, a lop-

(Continued on Page 14)

CENTURY JTR SOUND SYSTEMS — comparative size of complete single channel optical amplification system including power amplifier-preamplifier-volume control for an up-to-900-seat theatre.

Century Corporation's All Transistorized Sound System Said To Cost Less, Give Better Quality

By LARRY DAVEE
President,
Century Projector Corp.

The projectionist is probably the most important man connected with the motion picture theatre. Everything in the theatre is secondary to the things for which he is responsible.

Often concessions or other factors are thought to most important because of the presumably greater profits realized from their sale, but considered judgment can only conclude that the one and only reason for anyone attending a motion picture theatre is to see and hear entertainment (food and drinks may be obtained at any corner store). The best production, the most beautiful person in the world, the compositions of the greatest composers, the rare beauty of the world about us expressed in color fade into oblivion at the hands of an unqualified, inexperienced, lax projectionist.

On the other hand, most picture productions have a lot to offer and their acceptance by the public is enhanced manyfold by the careful manipulation of the projection and sound reproduction by projectionists who have the knowledge, initative and proficiency of their profession to operate the more modern equipment available to the theatres.

In the selection of equipment for any theatre the fundamental requirements that seem to transcend all others are these—

1 — Is it designed and manufactured to meet modern requirements?

2 — It is American-made?

3 — It is made in a factory where qualified skilled Union labor is employed?

4 — Has it been approved by the Underwriters Laboratories?

The motion picture industry of the United States would be in an untenable position if there were no American manufacturers supplying projection and sound reproducing equipment. There is only one American manufacturer left — Century Projector Corp. — manufacturing motion picture projectors and sound reproducing equipment exclusively and the only one manufacturing 70mm-35mm combination projectors capable of projecting either 70mm films or 35mm films. All other projectors are foreign made. It is desirable if not absolutely necessary that this great industry of ours have a source of equipment here at home where emergencies can be quickly and efficiently handled and where the knowledge and experience of American engineers and scientists are available to continue the research and development of new ideas, new operative techniques and new theatre attractions, to keep American theatres strong and American personnel employed.

It is most desirable that the equipment be manufactured in a factory by employees who are happy, well paid and able to live in an American society with proper and respected labor representation.

Let's look at the wage conditions existing in manufacturing plants of those who would import equipment into our country in competition with American labor. Some of these countries pay as little as 27c an hour — some others $1.25 per hour for skilled labor. These wages are in comparison with American wages of over $2.00 per hour for the same skilled labor. We must admit that American engineers, scientists and skilled labor are far and above superior to the average found in these countries.

My third point is a very important one. This relates to the approval of equipment by the Underwriters Laboratories — Claims are made for some foreign made equipment that such approvals have been obtained but it would be well to make sure because an accident involving a fire could abrogate the collection of insurance or the approval for operating a theatre, by fire inspectors charged with safe guarding public life and property.

Let us first examine Century's 70mm and 35mm reproducer illustrated here. This reproducer is unique and a most recent development.

Figure 1 shows the absolute control for the film under any and all situations — The film tension or, in other words, the pressure of the film against the magnetic cluster is independently adjustable to give the longest wear to the pick up heads and the optimum sound quality.

Figure 2, 3 and 4 show that at no time is there more tension on the film than as if the sound reproducer were not being used. These pictures also show that when the proper film tension is once set the upper magazine tension is adjusted to be exactly equal to it. The result is that the film has no pull on the sprocket holes whatever.

Attention is called to the use of the Davis flutter suppressor developed for the reduction of flutter with increased life of the film. This hydro-flutter suppressor won an Academy of Motion Picture Arts and Sciences Award for improved quality of sound reproduction in the motion picture theatre. Not only is this device used for improved

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The projectionists that attended the recent meeting of the 25 30 Club in New York saw a demonstration of an all Transistorized theatre sound system as well as observing the operation of the only 70-mm — 35mm projector and sound reproducing system manufactured in America. The meeting was sponsored by Larry Davee, president of the Century Projector Corp., an honorary member of the club. Mr. Davee discussed the projectionist's responsibility for the success of motion picture theatre operation.

UNION LABEL COOPERATION

At the recent Chicago meeting of the International Alliance of Theatrical Etage Employees and Moving Picture Machine Operators, considerable time was given over to the appearance of other crafts to publicize the Union Label cooperation plan.

INTERNATIONAL PROJECTIONIST is happy to participate in the Union Label campaign, not only to point up the constant cooperation between members of various crafts, but also to illustrate how completely INTERNATIONAL PROJECIST is the operator's publication — the voice of the motion picture projectionist.

reproduction in the theatre but it is now almost universally used for recording and rerecording in the Hollywood studios and elsewhere.

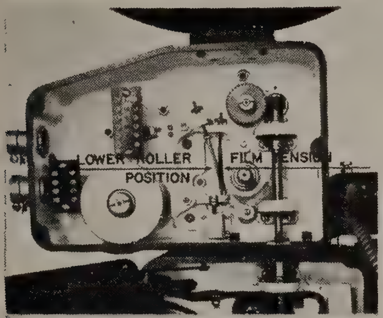
There are many things of interest about this Century, American designed and manufactured projector but I know that you are also interested in the all transistor theatre sound system.

The transistor is a unique thing and it is most difficult to explain how and why it works. There is a book, published by the Department of the Army for the purpose of educating Army personnel in the use of transistors. It shows how transistors are used for communications where power and size are limiting factors and where absolute reliability and freedom from maintenance are a must. Failure of these transistorized communication sets could be the difference between life and death not only to the individual but possibly to large groups involved in combat. This book proves without a doubt that proper use of transistors give a stability of operation, freedom from microphonics, saving of power, reduction of heat, improvement of quality and the virtual elimination of detailed field repairs. All of these factors are also the prime consideration for theatre sound systems.

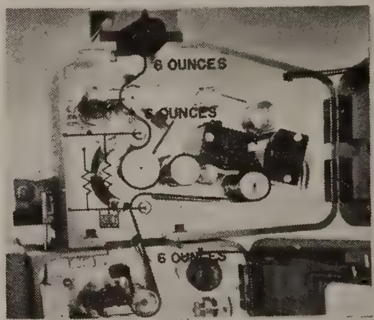
At present the maximum power available from power transistors is sufficient for 600 to 900 seat theatres. Therefore the front end of this all transistorized sound system is designed to work into a number of available vacuum tube power amplifiers such as those manufactured by Altec Lansing which, of course, work into Altec Lansing theatre loudspeakers. There is every indication that high power transistors may be available within the near future.

Probably one of the most unique parts of this new sound system is the sound reproducer. We call this an "Electronic Changeover." There are no moving parts, no switch contacts in the sound circuits, no relays, nothing mechanical to get out of order.

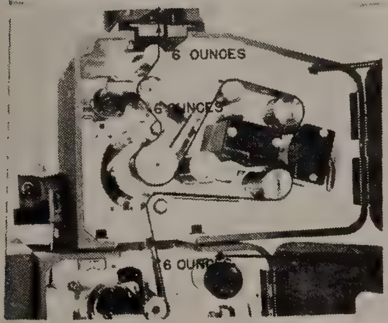
It's not done with mirrors but it is foolproof and stable and it is done by using unique transistor circuits. The changeover is smooth, noiseless and ac-



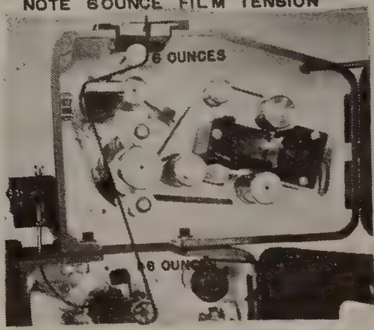
R-31-A REPRODUCER
(1) REAR VIEW— SHOWING ADJUSTING SPRINGS WHICH PROVIDE OPTIMUM SOUND REPRODUCTION WITH LOW CLUSTER WEAR



R-31-A REPRODUCER
(2) FRONT VIEW— SHOWING THREADING FOR 70 MM FILM- PHANTOM VIEW OF CONTROL SPRINGS AND DAMPER NOTE 6 OUNCE FILM TENSION



R-31-A REPRODUCER
(3) FRONT VIEW - SHOWING THREADING FOR 35 MM FILM. NOTE SAME 6 OZ FILM TENSION AS FOR 70 MM FILM NO SOUND SPROCKET LOAD



R-31-A REPRODUCER
(4) FRONT VIEW SHOWING BYPASS THREADING WHEN PROJECTING OPTICAL PRINTS- NOTE SAME LIGHT 6 OZ FILM TENSION

complished without "bumps" even when full music or speech power is being reproduced on both projectors. One push button making momentary contact changes the sound from one projector to the other where the volume has been set independently of the projector in operation. A selector switch predetermines whether six magnetic channels, four magnetic channels or a single magnetic channel or single channel optical sound is to be selected when the push button is operated. There are no latching push buttons or latching relays in the circuits. A photo-transistor is used in place of the ordinary (microphonic) photoelectric cell. The phototransistor picks up all of the light from directly in back of the film thereby eliminating all mirrors, lenses, etc., which have always been a source of trouble especially if the projector mechanism being used has a tendency to leak oil.

The complete sound system fits into the preamp compartment of the sound reproducer. Larger sound systems with multiple channels, dual facilities for emergency replacement would require additional space. However the complete front end of the multiple channel sound system including the preamps, switching amplifier, power supply, etc., is all housed as a part of the projector and reproducers. All wiring is prefabricated except that going to the power amplifiers and stage speakers.

It is anticipated that the saving in contract labor, conduit runs, inter wiring, etc., will be easily $2,000 to $4,000 per installation.

The first installation of this new Century all transistorized theatre sound system is scheduled for the New Mall Theatre in Paramus, N.J.

We believe that this new sound system will make the use of magnetic sound reproduction much more popular because of the improved quality of sound in the theatre and the elimination of the "hazards" of multiple track reproduction. This new sound makes the projection of multiple track films as easy and straightforward as a single track film. This should please all projectionists everywhere. It should also please theatre owners because of the lower price plus the additional saving of installation and routine service expenses. By this statement we do not infer that a multiple channel sound system will not require engineering supervision and lineup to adapt it to the particular theatre acoustics, etc. It does mean, however, a reduction in installation time, and service.

Claude McKean Joins Projected Sound

Claude McKean recently joined Projected Sound Co. as an executive sales representative. McKean had been with Warner Bros. as branch manager in Indianapolis for the last 23 years, and prior to that was with 20th-Fox for ten years and with RKO for nine years.

Projected Sound, Plainfield, Ind., was formed in 1959 by F. O. Hilligoss. The name of his previous business, Drive-In Theatre Supply Co., formed in 1958, was changed because the Projected Sound speaker became the main item of the business.

Hilligoss had been in the automotive equipment service business for 20 years before building the Corral Drive-In Theatre, Terre Haute, Ind., which he still owns and operates.

Two sons, Thomas F. and Forrest R., assist in the business. Tom is a graduate of Southern Methodist University, left the U.S. Air Force as first lieutenant after three years service at Carswell base and was with Republic Carloading until he joined his father.

Dick attended Purdue and Butler Universities had worked for Delta Air Lines before joining his father. He is plant superintendent.

Victor Animatograph Corporation Celebrates 50th Anniversary

The Victor Animatograph Corp., audio-visual division of the Kalart Co., celebrates its golden anniversary this year. The history of the company parallels the audio-visual field itself, with numerous Victor inventions and products playing a major role in contributing to the growth of the field.

When Victor was established in 1910 in Davenport, Iowa, its main concern was with the development of still picture projectors and slides. The first Victor products included the Stereotrope, utilizing a disc of transparencies for projection, and the Viopticon, a forerunner of the modern slidefilm projector. From the very beginning, however, the company's founder, Alexander Victor, was greatly interested in motion pictures for nontheatrical use. By 1918, Victor had succeeded in helping to establish a separate exclusive standard of safety (acetate base) film—28mm for nontheatrical use. Victor's Safety Cinema 28mm projector was introduced in that year.

The 28mm film standard — the first film standard adopted by the Society of Motion Picture Engineers — marked the real beginning of the nontheatrical motion picture field. Five years after its introduction, in 1923, this standard gave way to 16mm as being more practical and economical. Eastman Kodak Co. produced the first 16mm reversible film, and Victor introduced the first 16mm projector and camera in August, 1923. Thus within a period of only 13 years after Victor Animatograph Corp., was established, obstacles blocking the growth of the nontheatrical motion picture field had been removed, largely through Victor's efforts.

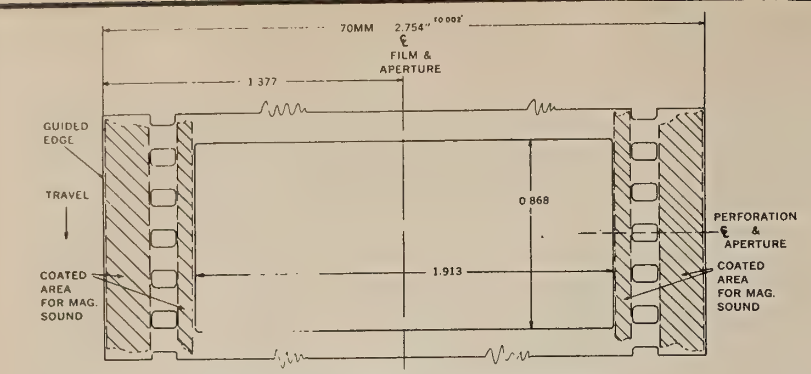
During the early years of 16mm silent film history, two Victor inventions contributed greatly to progress. One was the development of a continuous reduction printer for reproducing 35-mm productions on 28mm or 16mm film. The other was a device to prevent damage to film during projection — the Victor Safety Film Trips, still used today.

By 1930, sound had come to the theatrical film field and Victor introduced a 16mm sound-on-disc projector which gave way within three years to the first

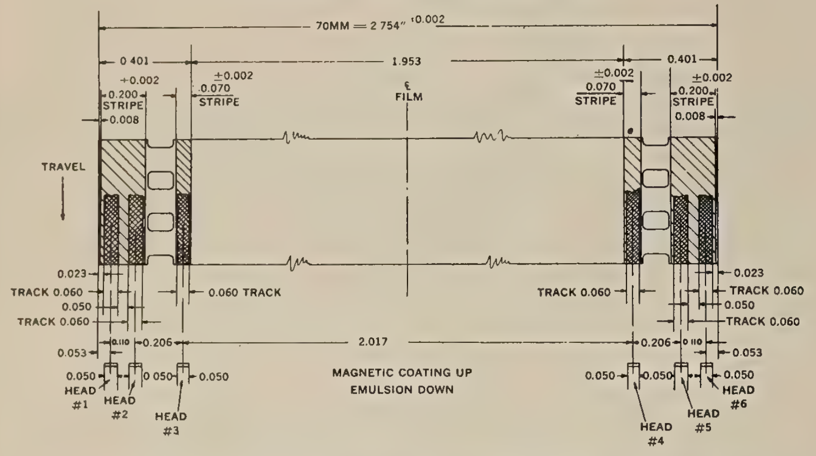
(Continued on Page 14)

Important Victor "Firsts"

- First to produce a portable projector arc-lamp
- First to introduce a concentrated filament incandescent lamp.
- First to produce a miniature slide — the forerunner of the presently used film slide.
- First to produce 35mm still projector.
- First to produce 16mm motion picture cameras.
- First to produce 16mm motion picture projector.
- First to produce magnetic recorder-reproducer attachment.
- First to produce 16mm sound-on-film motion picture projector.
- First to produce the revolving prism system.
- First to employ a stationary drum for sound.
- First to use safety film trip device for prevention of film damage.
- First to use the offset film loop.
- First to use the three lens turret.
- First to employ visual focusing.
- First to use slow motion on 16mm.
- First to develop self-centering arc lamp.
- First to develop continuous reduction printer for production of silent 28mm and 16mm films from 35mm.
- First to develop continuous sound reduction printer for production of 16mm sound films from 35mm.



BASIC DIMENSIONS RELATED TO SIZE AND PLACEMENT OF THE RECOMMENDED 70MM PROJECTOR APERTURE



MAGNETIC COATING AND TRACK PLACEMENT DIMENSIONS FOR 70 MM RELEASE FILM

Print and Projection Data For "Spartacus," U-I's Super Technirama 70-mm Release

BECAUSE MANY projectionists may find themselves faced with 70-mm projection and sound problems for the first time with the release of the Universal-International Bryna production, "Spartacus," filmed in Technicolor by the Super Technirama process, a review of basic 70-mm technical data is in order.

Except for the matter of film speed, which is 24 frames per second, the "Spartacus" print conforms to the aperture and soundtrack standards established by Todd-AO and now recommended by the SMPTE. Because there are 5 sprocket holes per frame, the rate of travel is aproximately 22½" per second, or exactly 112.2' per minute. The adoption of 24 f/s instead of the visually more desirable rate of 30 f/s makes the subsequent issuance of 35-mm CinemaScope prints of "Spartacus" virtually a certainty. (There are only about 200 70-mm installations in the U.S.A.)

The accompanying diagram, reproduced from the U-I Technical Information Bulletin, details the projector-aperture and 6-channel magnetic-track specifications for the 70-mm prints. The aspect ratio is 1:2.21, less than that of CinemaScope. Microscopic examination of a "Spartacus" print sample reveals excellent photographic resolution and fair depth of focus. The sample supplied, complete with magnetic striping, appears to be Eastman Color multilayer print stock.

The SCREEN CHART FOR 70-MM PROJECTION is based upon the Todd-AO projector aperture measuring 1.913 by 0.868" (aspect ratio 1:2.21). This, the first chart of its kind for 70-mm projection, was computed by the engineering department of U-I.

Particular attention should be given to the numbering of the magnetic tracks as shown in the diagram. TRACK 1 is for the left speaker, TRACK 2 is for the left-center speaker, TRACK 3 is for the center-stage speaker, TRACK 4 is for the right-center speaker, TRACK 5 is for the right speaker, and TRACK 6 is for the surround or auditorium speakers. As in the case of Todd-AO prints, the frame over the projector aperture must be 24 frames ahead of the take-off point in the magnetic sound reproducer. Other Todd-AO 6-track sound specifications are as follows:

1. The frequency response as measured on theatre equipment should be 50—8000 cycles flat within plus or minus ½ db, and 40—12,000 cycles flat within plus or minus 1½ db.

2. Cross-talk between channels, minus 40 db at 1000 cycles.

3. Signal-to-noise ratio, 55 db.

4. Wow and/or flutter not to exceed 0.2% in a bandwidth between 2 and 200 cycles.

5. Preamplifier distortion not to exceed 1% when operated at a level of 12 db above the level from magnetic film recorded at 3% distortion.

6. Power-amplifier distortion not to exceed 2% at the rated output of the amplifier between 50 and 12,000 cycles.

7. Speakers and power amplifiers should be of such power rating that

(Continued on Page 18)

SCREEN CHART FOR 70 MM PROJECTION

CONVERSION TABLE MM TO INCHES

66	2.60	85	3.35
70	2.76	90	3.54
75	2.95	95	3.74
80	3.15		

LENS FOCAL LENGTH IN MM AND INCHES

PICTURE WIDTH IN FEET	66 MM	70 MM	75 MM	80 MM	85 MM	90 MM	95 MM	4"	4¼"	4½"	4¾"	5"	5¼"	5½"	5¾"	6"
25	34.0	36.0	38.6	41.2	43.7	46.3	48.9	52.3	55.5	58.8	62.1	65.3	68.6	71.9	75.1	78.4
30	40.7	43.2	46.3	49.4	52.5	55.6	58.7	62.7	66.6	70.6	74.5	78.4	82.3	86.3	90.2	94.1
35	47.6	50.4	54.0	57.6	61.2	64.8	68.4	73.2	77.7	82.3	87.0	91.5	96.1	100.6	105.2	109.8
40	54.4	57.6	61.7	65.9	70.0	74.1	78.2	83.6	88.7	94.1	99.3	104.5	109.8	115.0	120.2	125.5
45	61.2	64.8	69.4	74.1	87.7	83.3	88.0	94.1	99.9	105.9	111.7	117.6	123.5	129.4	135.3	141.1
50	68.0	72.0	77.2	82.3	87.5	92.6	97.8	104.5	111.1	117.6	124.2	130.7	132.0	143.8	150.3	156.8
55	74.7	79.2	84.9	90.6	96.2	101.9	107.5	115.0	122.2	129.4	136.6	143.8	150.9	158.1	165.3	172.5
60	81.5	86.4	92.6	98.8	104.9	111.1	117.3	125.5	133.3	141.1	149.0	156.8	164.7	172.5	180.3	188.2
65	88.3	93.6	100.3	107.0	113.7	120.4	127.0	135.9	144.4	152.9	161.4	169.9	178.4	186.9	195.4	203.9
70	95.1	100.8	108.0	115.3	122.4	129.6	136.9	146.4	155.5	164.7	173.8	183.0	192.1	201.3	210.4	219.6
75	102.0	108.0	115.7	123.5	131.2	138.9	146.6	156.8	166.6	176.4	186.2	196.0	205.8	215.6	225.4	235.2
80	108.7	115.2	123.4	131.7	140.0	148.2	156.4	176.3	177.7	188.2	198.6	209.1	219.6	230.0	240.5	250.9
85	115.5	122.5	131.2	140.0	148.7	157.4	166.2	177.7	188.8	200.0	211.1	222.2	233.3	244.4	255.5	266.6
90	122.3	129.7	138.9	148.2	157.4	166.7	176.0	188.2	199.9	211.7	223.5	235.2	247.0	258.8	270.5	282.3
95	129.1	136.9	146.6	156.4	166.2	175.9	185.7	198.6	211.1	223.5	235.9	248.3	260.7	273.1	285.5	298.0
100	135.9	144.0	154.3	164.7	174.9	185.2	195.5	209.1	222.2	235.2	248.3	261.4	274.4	287.5	300.6	313.6
105	142.7	151.3	162.0	172.9	183.6	194.5	205.3	219.6	233.3	247.0	260.7	274.4	288.2	301.9	315.6	329.3
110	149.5	158.5	169.7	181.1	192.4	203.7	215.0	230.0	244.4	258.8	273.1	287.5	301.9	316.3	330.6	345.0
120	163.0	172.9	185.2	197.6	209.9	222.2	234.6	254.9	266.6	283.3	298.0	313.6	329.3	345.0	360.7	376.4

FIGURES IN THE ABOVE TABLE SHOW PROJECTION DISTANCE IN FEET FROM PROJECTOR APERTURE TO CENTER OF SCREEN.

Width:	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	120
Height:	11.3	13.6	15.8	18.1	20.4	22.6	24.9	27.1	29.4	31.7	33.9	36.2	38.5	40.7	43.0	45.2	47.5	49.8	54.3

VICTOR

. . . Continued from Page 11

16mm sound-on-film projectors — 25 years later a search for the ten oldest Victor sound-on-film projectors still in operation turned up ten models all produced during 1933.

One important factor in the practical use of 16mm sound-on-film movies was Victor's invention of the continuous sound reduction printer. This device was not patented, but presented to the entire industry as a Victor contribution. Still in use today, the invention makes possible printing of picture and sound from 35mm film to 16mm film by direct reduction.

Alexander F. Victor, the man responsible for so much progress in the audio-visual field, is living in active retirement today, as is Samuel G. Rose who started with Victor in 1910 and succeeded him as president of Victor Animatograph Corporation in 1946. Since 1956, when the entire Victor operation was moved from Davenport to Plainville, Victor has been a division of the Kalart Company, Inc. The Victor tradition of fine workmanship and constant product improvement is carried on at Kalart's modern Plainville, Conn. factory.

GENEVA

. . . Continued from Page 7

sided intermittent sprocket, and a bent starwheel shaft. No framer position will remove the dancing when any of these other defects is present — a useful test to keep in mind.

Projectors in which framing of the picture is accomplished by raising or lowering the entire intermittent movement, as in the Powers and all Motiograph models, make use of the same sprocket teeth relative to the pulldown position of the film frames regardless of the position of the framer. (It should be noted that film seldom meshes perfectly with the sprocket teeth: the lion's share of the wear is inflicted upon every fourth tooth on each side.) For this reason, 6-cycle picture dancing will not occur with Motiograph projectors when the picture is framed.

To prevent 6-cycle image dancing due to irregularly worn sprocket teeth in Simplex projectors and their Chinese copies, change the position of the framer about once a week instead of leaving it in the midway position all of the time. This will distribute wearing of the teeth in a more regular manner.

Replacing Sprockets

The reversal or replacement of intermittent sprockets is time-consuming in the case of Simplex Regular and Super mechanisms because the entire movement must be removed from the machine, taken apart, and then reassembled and readjusted before putting it back into the mechanism. Many projectionists avoid this chore simply by obtaining a replacement movement and sending the theatre's movement to the repair shop for a new sprocket. Other projectionists, however, have had years of experience in changing Simplex intermittent sprockets, and prefer to do the job themselves.

The star-and-cam relationship is also disturbed whenever Simplex E-7 intermittent sprockets are replaced. The E-7 movement need not be entirely removed from the machine, but the cover-plate and the starwheel are taken off together with the sprocket, shaft, and outboard bearing. Moreover, the soundhead drive-gear must be removed to enable the E-7 mechanism to be turned by hand with the shutter-shaft knob in order to get the "feel" of the star-and-cam "radius" adjustment when the sprocket is replaced without removing the intermittent movement from the machine.

The Brenkert has a special single-bearing intermittent which makes it possible to change the sprocket without touching the movement. For the same reason it is very easy to change the intermittent sprockets of such standard European machines as the Ernemann, Bauer, Euro, Bofa, Aga-Baltic, etc. A few European projectionists even go so far as to remove the intermittent sprockets of their projectors for routine cleaning!

It is also possible to remove the intermittent sprockets of such modern American projectors as the Simplex X-L and the Motiograph models AA and AAA without the necessity of removing the movements. Nevertheless, these projectors have outboard bearings which must first be taken off.

Radius Adjustment Critical

The so-called "radius adjustment" refers to the adjustment of the closeness of the starwheel to the cam. It has to be made with the greatest care because a geneva intermittent does not work well if this adjustment is too tight or too loose.

The intermittent movements of nearly all the older Simplex-type projectors should be taken out in order to make the radius adjustment, although this adjustment can also be made, if care is used, with the movement still in the machine. It is necessary, in this case, to remove the soundhead or main-drive gear so that the mechanism may be turned over by hand to get the "feel" of the intermittent movement. The actual adjustment is made by loosening the cover-plate screws on the operating side.

(Continued on Page 16)

TOA Survey Shows Reduction In Two-Man-Booths

LOS ANGELES — "The era of the two-man booth is rapidly disappearing in the motion picture theatre industry," is the finding in a special survey made by Theatre Owners of America made public by TOA in its convention handbook.

Two-man booths," says the survey, "now exist only in the larger cities, in some larger, newer drive-ins and in virtually every road-show operation house."

"The hard core of remaining two-man booth operations" was revealed to be "in the East — the New York and New Jersey area. Elsewhere in the country it is only in the first-run big city operations that two projectionists are still to be found in the booth."

"With virtually no exceptions," said Al Floersheimer, TOA's director of public relations, "theatres in the last decade have reduced from two to one man by granting the remaining man pay boosts that ranged from 25 to 50 per cent and averaged about 33 per cent. This has resulted in substantial savings for theatres because in the average operation the booth constitutes a major portion of the operating 'nut.' "

"The changeover for most of the rest of the country," Florsheimer said, "has come within the last 10 years and has been intensified in the last five years, concurrent with the fall-off of attendance and gross from the World War II and Korean conflict peaks up to 1947-48. That was the period when theatre men were faced with greatly reduced earnings and began taking more looks at their operating expenses to see where savings could be made which would enable them to adjust to the lowered income."

While the survey was said to have disclosed "some instances of near-strikes to accomplish the reduction" the findings show that "in the majority of instances the motion picture operators' union, the IATSE, recognized the plight of the theatres and reluctantly but realistically agreed to the reduction."

"The unions apparently realized that the financial plight of the theatres was real, that many would actually close if booth costs along with other operating expenses could not be cut, and accepted the proposition that it was better to sustain one job than to lose two completely if the theatre closed."

Floersheimer noted that "two 'new' exceptions to the one-man booth trend are relatively recent developments in the industry — the spread of road shows and the advent of multi-screen drive-in theatres."

"Without exception," he said, "two or more men work advanced-price, limited-showing engagements of 65 and 70mm pictures. And two-plus screen drive-ins, which either use separate booths or reflective devices to present two or more pictures simultaneously, also have more than one projectionist.

"Otherwise, with the exception of the East where two-man booths still exist in the first-run houses of some smaller cities, two-man are confined mainly to the downtown first-run houses of the key cities. And even here, execpt in the really deluxe movie palaces, two operators are rapidly disappearing."

"Technicians are also quick to point out that the switch from the inflammable nitrate-film to the safer acetate stock has also been an important factor in the gradual elimination of two-man operations."

Note was made of the fact that "many states have rewritten their safety and projection codes in recent years to eliminate the two-man requirement heretofore mandatory for nitrate film."

GENEVA

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Also, the oil should be drained from the intermittent oilwell before loosening the cover-plate, otherwise the mechanism and soundhead will be inundated by a flood of oil. There is no such danger in the Motiograph, as the intermittent of this make of projector is lubricated with grease.

The projectionist man save himself a great deal of time and trouble, however, by first making sure that a readjustment of the star-and-cam relationship is necessary. Such a readjustment is certainly indicated if the movement is noisy when run without film and with the film-gate open; and it is also indicated when the intermittent sprocket has backlash in the locked, or "at-rest," position.

Backlash between the star and cam results in jumpy pictures.

Increasing gate tension on the film is definitely the wrong way to get rid of picture-jump from this cause. Excessive gate tension will ruin the film, especially "green" prints.

Kid projectionists operating old-time toy movie machines could not alter the star-and-cam relationship, but a professional projectionist, working with professional machines, can!

Testing the Radius Adjustment

Suppose you aren't certain whether the star-and-cam adjustment in your projector can be improved. Fortunately, decisive tests are available.

1. An adjustment should be made if the intermittent movement runs noisily with no film in the machine and with the film-gate door open.

2. An adjustment should be made if, with your fingers, you can feel backlash in the "locked" intermittent sprocket.

3. An adjustment is also in order if, when the mechanism is disconnected from the soundhead and motor by removing a drive gear, and the mechanism is turned over with the shutter-shaft knob, you can feel it bind when the intermittent sprocket is at rest ("locked" position).

4. Also, when the projector is running normally, but without film and with the gate open, a **pronounced clatter** is heard each time the periphery of the sprocket is struck tangentially in the direction of its rotation with the side of the forefinger of the right hand. This test should be repeated with the framing knob set at several different positions, ranging from one extreme to the other.

A very slight clatter heard when the sprocket is struck in this manner indicates a correct radius adjustment.

A pronounced clatter indicates that the adjustment is too loose, whereas noisy operation without additional clatter when the sprocket is struck with the finger indicates too tight an adjustment.

(Tests for the Brenkert, but applicable to all other geneva projectors.)

It should be noted that excessive end-play in the cam or flywheel shaft can also result in noisy intermittent operation. This condition can be detected by pressing in on the end of the flywheel shaft (drive side) while the machine is running.

Special Instructions

Don't neglect studying those service and maintenance booklets! If you have none for your make and model of projector, request a copy from the manufacturer or your local dealer. Without exception, the manufacturer's instructions should be diligently followed when removing an intermittent unit from the mechanism, adjusting the star and cam, taking up end-play in the flywheel, or changing the intermittent sprocket.

Just for the sake of review, we herewith give in outline form the instructions for removing the intermittent and making the radius adjustment in the Simplex Regular and Super, and also in the Motiograph AA and AAA.

SIMPLEX REGULAR & SUPER (Movements identical)

Removal. Open film gate. Remove sight box (operating side), main drive gear (drive side), and intermediate gear-shaft retaining collar (operating side). Swing film stripper out of the way. Loosen intermittent clamp screws and push them out of the way toward sprocket shaft (operating side). Rotate framing knob until oil-tube is clear (drive side). Grasp the intermediate gear in the left hand and the intermittent flywheel in the right hand, and withdraw both from the drive side of the mechanism.

Radius Adjustment. Drain oil from the movement, remove cover together with star, shaft, and sprocket if it is desired to inspect condition of star and cam, taking care not to tear or wrinkle the oilpaper gasket.

Otherwise merely loosen cover screws, hold the movement level and with the star directly above the cam, and turn flywheel until sprocket is in middle of "locked" position. Let the star settle onto the face of the cam by the weight of the cover and its star and sprocket. Tighten cover screws.

Readjust if (1) there is backlash of the sprocket in the locked position, or (2) if the flywheel binds when sprocket is in locked position.

Replacement. The procedure of removing the intermittent movement is followed in reverse. To make sure that shutter synchronism is restored, thus avoiding the job of resetting it, mesh the intermediate gear with the flywheel gear so that the white dot on the intermediate gear is as close as possible to the "0" mark on the intermittent flywheel. Be sure to refill the intermittent oilwell with fresh oil before projecting pictures, although brief screen tests of the intermittent adjustment can be made before this is done.

MOTIOGRAPH AA & AAA (Movements identical)

Removal. (A) Remove framing knob and covers on drive side. Remove intermittent flywheel by taking out the two Allen screws that lock the flywheel to the cam shaft. Turn the framing knob to its "down" position. Open film gate and close lower-sprocket pad rollers.

(B) Release (do not remove) the Allen screws on the movement-holding clamps, and push clamps away from the movement (operating side). Rotate movement a quarter turn clockwise. The movement can then be pulled from the operating side.

Radius Adjustment. NOTE: The cover of the Motiograph intermittent is **movably pinned** to the main casting of the movement at a point just to the left of the lower cover screw.

Loosen slightly all four socket-head cover screws to allow cover to swing on pivoting pin. Next locate the two screws set into the rim of the cover. (These extend **in** toward the interior of the movement from the periphery of the cover rim.) By backing **out** one screw and tightening the other, the radius clearance may be tightened or loosened. Test the adjustment by checking the intermittent sprocket for backlash in the locked position (too much clearance), and by checking the movement for binding when star and sprocket are locked (too little clearance).

MONTHLY CHAT

. . . Continued from Page 3

The projection-automaton robot knows nothing, it cannot see, hear, or think, and it cannot handle emergencies or make instant changes in its routine to suit momentary circumstances. All it can do is turn a multitude of switches on and off — an inhuman horror of scientific stupidity which first appeared in Germany to turn the movie theatre into a museum of mindless mechanization. And how does a German manufacturer of automatic-projection gadgets view the future of the art? Just listen to this:

"Because threading must be done by hand, the use of 200-ft. reels makes automation look ridiculous. If 6000-ft. reels are employed, however, the normal film length of a program can be divided between the two projectors, relieving the projectionist of having to thread up every 20 minutes. He is, however (according to German law), not allowed to leave his place beside the projectors; but the exclusive use of safety film will probably soon result in dropping this clause, as well as the one permitting the use of 2000-ft. reels only."

In other words, Mr. Projectionist, every effort is being made to number your days as the Chief Showman of the motion-picture theatre, even though your demise as a screen artist will cost exhibitors a great deal of money in incredibly expensive equipment servicing and in lost patronage.

Reports reaching this writer from users of projection automatons undeniably indicate that more expensive labor is required to keep these gadgets working than to operate a roomful of superior carbon-arc projectors by skilled human effort. So take heart, Mr. Projectionist: your days may be endless — at least in a country like the United States where only the most flawless and high-powered projection is acceptable! No mechanical device, we repeat, can inject **showmanship** into a screen performance; and without this essential ingredient a movie show becomes unavoidably clumsy and "dead," very uncertain as to its outlasting breakdowns, and completely unsatisfactory on the basis of ordinary audiovisual standards.

Only a professional projectionist, and not a machine pre-set by theatre managers to show film inspected, threaded, and rewound by ushers, can provide an acceptably professional performance in the commercial motion-picture theatre.

The projection process, let it be remembered, is unique in that it requires the services of a specially skilled showman who controls every single moment of the screen presentation **and keeps the show rolling without flaw, without interruption, and without breakdown.** The paying public, long accustomed to cinematic showmanship and giant screens brilliantly illuminated by the high-intensity carbon arc, will rebel at the substained quality of "automatic projection" and of the inferior light sources it requires. This must never happen in America, where the movies are regaining their rightful popularity and prestige as an entertainment medium.

R. A. MITCHELL

70-MM PROJECTION

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any single track can properly fill the acoustical needs of the auditorium.

All necessary test films for checking 6-channel magnetic sound installations, as specified by the foregoing, are available through the Todd-AO Corp., West Coast Division, 1021 N. Seward St., Hollywood, Calif.

The distributors of "Spartacus" rightly warn against the use of unsuitable lenses for projecting 70-mm pictures. **Only lenses especially designed to cover the 70-mm aperture should be used.** DO NOT project 70-mm prints with lenses designed for 35-mm apertures. DO NOT project 70-mm prints by using supplementary lenses, lens attachments, or focal-length converting devices — they always deteriorate picture quality as compared to lenses designed for the job.

A Motion-Picture Research Council 70-mm projector alignment film having a test chart should be used to check lens performance for the cleanest, sharpest projection. This test film is available through supply houses and shipped with an instruction sheet. It can also be ordered from the SMPTE, 55 W. 42nd St., New York 36, N.Y.

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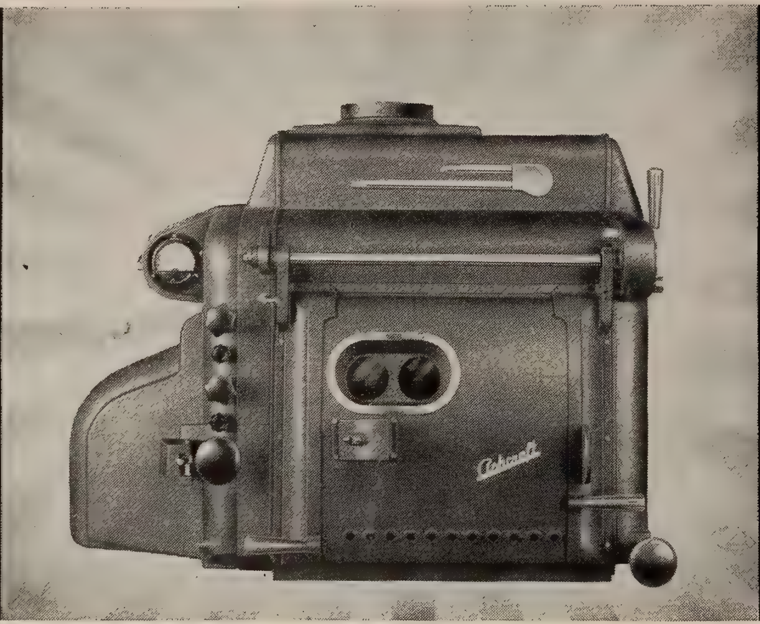

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RAY GALLO
General Manager

MIDWEST OFFICE
4616 Washburn Avenue South
Minneapolis 10 Minnesota

FRANK W. COOLEY, JR.
Editor and Publisher

R. ENTRACHT
Associate Publisher

RAY GALLO
General Manager

R. A. MITCHELL
Technical Editor

In This Issue . . .

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MONTHLY CHAT

Movie Prosperity Endangered By Obsolete Booth Equipment

ALL BUSINESS INDICATIONS permit us to predict with confidence that motion-picture exhibition is being swept onward to new heights of prosperity by a swelling wave of enthusiastic cinema attendance.

Theatres which had been consigned to oblivion a few short years ago are being reopened to accommodate an expanding public of appreciative moviegoers. Beautiful new theatres, both indoor and drive-in, are being built—additional proof that theatre movies are a solidly established entertainment medium for which there is no substitute. But the picture is not without a serious flaw.

The new prosperity of the exhibition industry is being threatened by the widespread use of projection and sound equipment which fails to translate to the screen the high degree of technical perfection which characterizes modern films and which constitutes their "audiovisual drawing power." Thousands of theatre owners, ignoring the public demand for pictorial realism and high-fidelity sound, persist in the delusion that outmoded and defective equipment is good enough for the job. Some exhibitors even refuse to buy such vital replacement parts as intermittent sprockets and arclamp mirrors!

Average Booth an Antique Museum

Excessive parsimony in the projection room is worse than mere false economy: it amounts, in fact, to outright sabotage of the "heart of the theatre" and, in consequence, of the boxoffice itself.

How can we account for this "penny wisdom and pound foolishness" which limits the prosperity of many theatres to the bare margin of profitable operation? Why the traffic in obsolete "rebuilt" projectors which are disastrously inefficient by modern standards? Why the failure to replace 1920 mechanisms, 1930 soundheads, 1940 arclamps, and 1950 aluminized screens **at a time when none of these oldstyle units can deliver the quality of performance demanded by the movie patrons of 1960?**

Exhibitor Trapped by Costs

The equipment manufacturers are not at fault, inasmuch as projectors, lamps, and sound systems of advanced design are available for the brilliant, lifelike reproduction of modern widescreen pictures and full-range sound recording.

Who, then, is to blame? The proverbially "short-sighted, penny-pinching exhibitor"? Hardly, since these myopic gentlemen are in the minority. Most theatre owners are alert, progessive businessmen who are fully aware that the prosperity of the industry depends in a large measure upon a continuing investment in the quality of the picture on the screen. These men know that the theatre having the brightest, clearest, steadiest pictures and the most lifelike sound gets the lion's share of the business, other factors contributing to patron satisfaction and comfort being equal.

High Cost of Bitter Experience

The answer to the riddle is written in red ink on the pages of the exhibitor's ledger. Aside from prevailing sky-high operating expenses, including film rentals, the costs of equipment he was forced to buy during the past decade have not yet been entirely written off. And most of this expensive equipment is now as useful as a herd of white elephants! Past experience has understandably soured the exhibitor on the idea of investing in better 35-mm projection and sound

(Continued on Page 19)

INTERNATIONAL PROJECTIONIST

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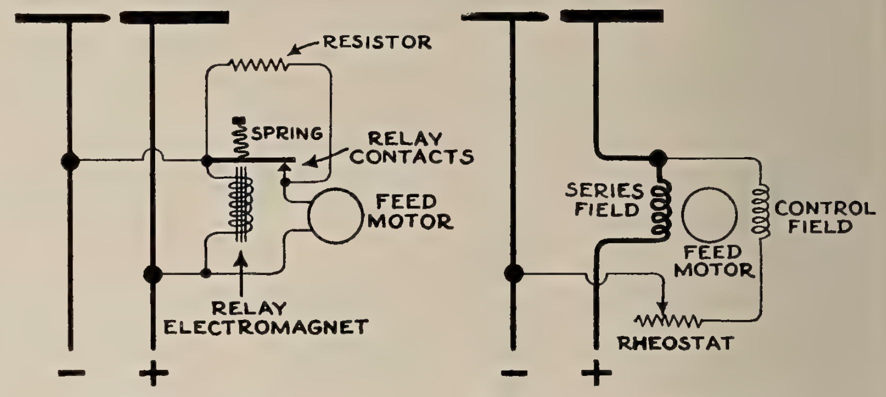
Evolution of Arc Controls

The Modern Reflector Arc Is the Most Dependable and Economical Wide Screen Projection Illuminant

By *ROBERT A. MITCHELL*



Relay-type arc feed mechanism

Continuous-type arc feed mechanism

FIG. 1 — The two basic types of arc-feed mechanism. The relay type depends upon the actuation of an electromagnetic relay to switch the feed motor on and off. (A resistor is usually shunted across the relay to keep the motor running slowly between "cycles.") The continuous type has a series motor connected across the arc, the varying arc voltage, or "drop," making it run faster or slower to maintain a constant length of arc gap. The opposing "series field" connected in series with the arc affords additional control, but is not always used.

THE CARBON ARC has been universally regarded as the ideal light source for motion-picture projection ever since the earliest days of the art, and rightly so. The radiant crater of the positive carbon rivals the sun, itself, in brilliance, and is sufficiently concentrated in area to make possible the most efficient optical transmission of the light. No other light source can even approach the high-intensity carbon arc in usable illuminating power or adequately light giant wide screens. Moreover, a modern HI reflector arc is the most dependable and economical projection illuminant to operate.

The earliest projection arclamps were vastly different from modern reflector lamps, and were much less efficient. These were the old low-intensity "vertical arcs" having the carbons slightly inclined from the vertical, and with the positive carbon in the upper position so that the brilliant positive crater partially faced the large condenser lenses which focused the light upon the film aperture.

Old LI Arcs Slow-Burning

Vertical arcs burned carbons of very large diameter for the current used. Thus a 100-amp. vertical arc burned a low-intensity positive 1-in. in diameter with a 7/16-in. negative. This and other vertical-arc trims burned so slowly, however, that none of the early lamps — boxlike "tin Lizzies" — were equipped with automatic carbon-feeding mechanisms. The projectionist twisted a couple of knobs from time to time to advance the carbons and to keep the "spot" centered upto the aperture.

Only a few real "old-timers" among IP's readers can fully appreciate how hot those vertical-arc lamps were. They converted most of the electrical energy into heat, and even at that, most of the light they produced was wasted by inefficient condensing-lens optical systems.

Even though a trim of carbons would last for a couple of shows, old-time projectionists nevertheless found hand-feeding of the arc an irksome duty — especially because most projectors had to be cranked with the right hand while the arc was controlled with the left hand! The "golden era" of silent films was not all beer and skittles.

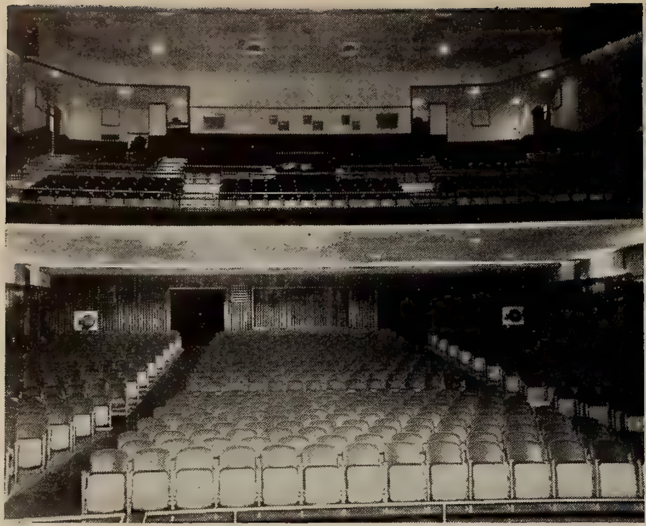
The late Harry Strong, founder of the company which was later to assume a position of leadership in the projection-arc field, was the first to heed projectionists' complaints in this regard. In 1922 he built an arc-control mechanism which was automatically regulated by the voltage drop across the arc. Strong's device could be attached to almost any vertical-arc lamphouse, and was given its successful trial run in the old Hart Theatre in Toledo, Ohio — the very same theatre where Ted Lewis with his "Is everybody happy?" routine got his start in show business.

Harry Strong's automatic feed for LI vertical arcs worked so well, and was so enthusiastically received by projectionists, that he built and sold dozens of them before embarking upon the manufacture of complete automatic projection lamps of his own — the first to bear the world-famous Strong nameplate. The Hallberg was another brand of feed mechanism made for attaching to old-style vertical arcs.

Later Arc-Control Problems

The first high-intensity projection arcs made their appearance in Germany in 1918. These burned relatively small, specially cored carbons developed by Heinrich Beck in 1913 for use in German military searchlights during World War I. The high-intensity carbon arc is still called the "Beck arc" in Europe.

(Continued on Page 15)



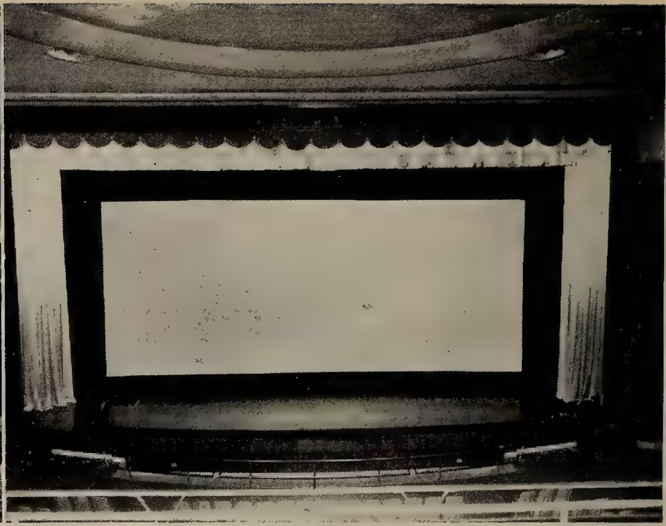


FIG. 1 — The 1100-seat auditorium of the New Palace as seen from the stage. The seating capacity will be increased to 1600 when car-parking facilities have been augmented. The surround loudspeakers are enclosed in recessed squares on the side and rear walls.

FIG. 2 — Multipurpose 60x30-foot Super Perlux screen in the New Palace Theatre of Katong, a suburb of Singapore. This truly modern screen is only moderately curved, and is fitted with electrically controlled side and top masking for all aspect ratios from the conventional 4:3 proportional aperture to CinemaScope and Todd-AO 70-mm presentations.

New Singapore Theatre Employs 70/35mm Process With Stereophonic Sound

WITH THE opening of Katong's New Palace Theatre, this fast growing Singapore suburb now possesses one of the finest theatres in Malaya. Seating eleven hundred patrons in air-conditioned comfort this modern theatre is provided with the most up-to-date equipment designed to give its patrons the very highest standard of Cinema and Theatre entertainment.

With the initial planning of the Palace Theatre, Singapore's leading cinema engineers, Messrs. H. A. O'Connor & Co. Ltd., were consulted by the board of directors and the architects to ensure that the interior of this most modern theatre was accoustically perfect. As one of the largest contractors, Messrs. H. A. O'Connor were responsible for supplying not only the projection and sound equipment, but also the theatre seating, safety fire curtain, stage lighting equipment, stage public address equipment, stage curtains and draperies and numerous associated equipments.

Commencing with the projection room, the equipment here consists of the Gaumont-Kalee Cinemeccanica combined 70/35mm Projectors designed and manufactured by the Cinemeccanica Company of Milan, Italy in conjunction with Rank Precision Industries Ltd., London. This most versatile projector will handle 65/70mm films and all 35mm film processes, such as regular, CinemaScope, VistaVision, SuperScope etc., with minor adjustments to the mechanisms that can be effected in several minutes. The projectors are equipped to handle six channel magnetic sound for Todd-AO, 3 or 4 track magnetic sound for CinemaScope, 1-track mixed magnetic sound, Perspecta Sound or 1-track optical sound.

The Gaumont-Kalee Sterephonic Magnetic 6 Track Sound System—the most modern and up-to-date theatre sound system as yet devised—with its magnetic preamplifiers and massive power amplifier channels, has been methodically and painstakingly designed to supply the five giant stage loudspeaker system together with the auditorium-effects loudspeakers with sound reproduction of the highest order.

The brilliancy of the projected picture comes from the powerful Gaumont-Kalee Super Zenith 18" arclamps. These arclamps with their automatically controlled carbon feed operate at a maximum of 130 Amps. The current for these powerful projection lamps is derived from the Gaumont-Kalee 140 Amp. heavy duty three-phase selenium arc rectifiers which are operated by remote control from the projectors.

Next comes the big Todd-AO screen. A most striking and significant part of this theatre's projection system is the moderately curved concave Gaumont-Kalee Super Perlux Todd-AO screen. It is important to understand the visual significance of this curved wide screen which is responsible for many of the remarkable visual effects which would be impossible without it.

Perhaps the most important visual effect from this wide curved screen is the distinct sensation of personal participation experienced by the audience both physically and emotionally. The resulting effect of being caught up in the motion and emotion of the show cannot be properly described — it must be experienced to be appreciated.

This giant screen is housed in a steel frame completely with its electrically controlled side and top masking equipment. The complete assembly can be

(Continued on Page 14)

The Eternal Misunderstanding: IP Gets Caught In Shutter Controversy

R. A. Mitchell, Technical Editor of IP, herewith presents a clarification of his recent 2-part article on projector shutters (IP for August and September, 1960), together with new data on double-shutter performance too important to wait for later publication.

By ROBERT A. MITCHELL

THERE IS NO AGREEMENT among projector manufacturers as to which is the best type of shutter. The various kinds of shutter arrangement used in American projectors are illustrated in the accompanying diagram.

The manufacturers of arclamps, on the other hand, subscribe in a general way to the data determined and published nearly three years ago by the McAuley Mfg. Co. of Chicago, then the maker of the Magnarc, the Hycandescent, and other widely used arclamps. These data are summarized in the accompanying table.

The McAuley data agree with the statements anent shutter efficiency in my article, except for the cylindrical shutter rated by all American lamp manufacturers as low in efficiency with lamps which are optically "faster" than f/2.0. However, according to the generally accepted McAuley data, the cylindrical shutter is slightly superior to the double disc type of rear shutter under conditions of low screen luminance, as in drive-ins, where the blades of the shutter can be considerably trimmed in width without revealing travel-ghost. Although these data support the views expressed in my article, I must confess that I am at a loss to understand why the double disc rear shutter could not be trimmed slightly more for greater light transmission under these conditions.

The single rear disc shutter—the old "Super Simplex type" of shutter—makes a very good showing in these data, particularly under drive-in conditions, hence I am required to retract my previously stated view that this type of shutter is the least efficient of all. Nevertheless, I am sincerely sorry that a few of IP's readers (certain projector dealers in particular) gained the impression from the article that modern projectors employing rear disc shutters are somehow inferior in light transmission. To the contrary, it has been known to all of us for a long time that such factors as beam clearance between the arclamp cone and the aperture, and the ability of a mechanism to accept large-diameter "fast" lenses, are more important than shutter transmission considered by itself. Some of these rear disc-shutter mechanisms are among the most efficient known.

It was specifically stated in the shutter article, and the McAuley data agree, that the type of conical shutter used in the Simplex X-L is the most efficient of all under every conceivable condition of 35-mm projection. Curiously, the McAuley data impart greater efficiency to the single than to the double disc shutter for drive-in projection! The inference which one would naturally arrive at here may be a mistaken one as we do not know whether any attempt was made to trim the blades of the double shutter beyond the angular width supplied by the manufacturer. Be that as it may, I have

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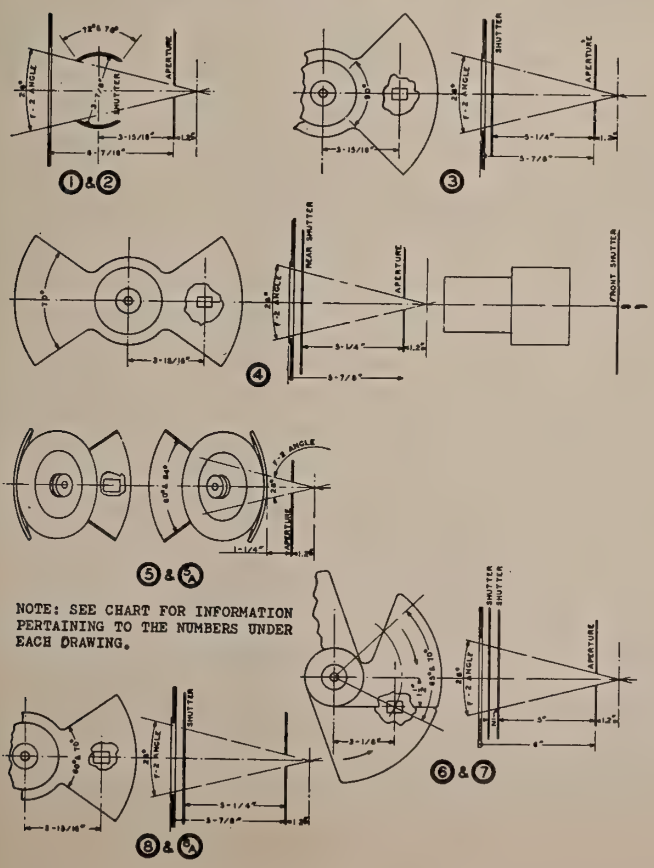
SHUTTER CHARACTERISTICS



NOTE: SEE CHART FOR INFORMATION PERTAINING TO THE NUMBERS UNDER EACH DRAWING.

— TABLE —

PERCENTAGES OF TOTAL LIGHT PASSED FROM THE SAME f/2.0 LIGHT SOURCE BY SINGLE AND DOUBLE 2-BLADE SHUTTERS TRIMMED (1) FOR GENERAL USE AND (2) FOR DRIVE-IN USE WITHOUT PERCEPTIBLE TRAVEL-GHOST. (Data previously published by J. E. McAuley Co.)

(LISTED IN EACH CATEGORY IN THE ORDER OF TRANSMISSION EFFICIENCY)

	GENERAL USE	
TYPE	BLADE WIDTH	TRANSMISSION
Cylindrical	78°	38.7%
Single rear disc	90°	50.0%
Double rear disc	70°	53.0%
Front-and-rear disc	70°	53.0%
Conical (Simplex X-L)	84°	56.5%

	DRIVE-IN USE	
TYPE	BLADE WIDTH	TRANSMISSION
Double rear disc	65°	56.0%
Cylindrical	72°	57.8%
Single rear disc	70°	61.0%
Conical (Simplex X-L)	60°	66.7%

(Front & rear combination not used in drive-ins)

Conclusions:—The Simplex X-L conical shutter is by far the most efficient in light-transmitting power. The cylindrical shutter is slightly superior to the double rear disc shutter for drive-in projection. The double disc shutter has a greater transmission than the single disc for indoor projection at maximum light levels. See text for an unusual advantage of double disc and double-acting cylindrical shutters not previously publicized.

Higher Screen Brightness From Kodak Process

ROCHESTER, N.Y.—Eastman Kodak Company has developed a new surfacing material for projection screens which gives a brightness gain of several hundred times over the usual beaded screens.

There is no immediate application or immediate future adaptability to motion picture screens in theatres, however. The new material was developed for military applications and so far Eastman's engineers and scientists up at Kodak Park in Rochester have been so busy down this avenue that they haven't explored any other areas, such as probable use for professional motion pictures. That's a matter for the future.

Military pilots will be able to watch radar screens in bright daylight right in the cockpit, as a result of the new Kodak surfacing material for projection screens giving—in special applications—a brightness gain of several hundred times over the usual beaded screens.

Allen F. Fultz, superintendent of optical instrument design at Kodak's Apparatus and Optical Division in Rochester, described the bright-screen projection system for the first time at the recent fifth annual technical symposium of the Society of Photographic Instrumentation Engineers in Los Angeles.

The new material is a film base embossed with 1,000,000 lenses, mirrors, or prisms per square inch, coated with a highly reflective aluminized layer. Possible applications include projection of television images or data displays for air weapons systems, Fultz said.

Pictures with excellent highlight brightness have been obtained in aircraft flight simulators on an experimental basis with a small cathode ray tube projector, he reported.

In actual flight, cathode ray tube displays that now require darkness for viewing might be projected on a screen in full daylight view of the pilot. Because of the selectivenes of the system, which depends for brightness on the position of the observer, images from separate projectors can be shown on the same screen. The images are viewed individually by the pilot and co-pilot from different angles, Fultz explained.

Fultz said the type of optical element used in the surfacing material can be chosen to broaden or narrow the audience space. The narrower the audience space—the space limited by the positions where the screen image can be seen—the brighter the image.

Several images may be projected on the screen simultaneously and each viewer will see from his position only those intended for him.

There will be no conflict or disturbance of the images. Fultz said. Light from outside sources is concentrated by the screen in audience spaces away from the observer's position, he explained.

N.Y. ASSOCIATION OFFICERS —— Elected recently at the 1960 Fall Meeting of The New York State Association of Motion Picture Projectionists are: (Front Row, left to right) Charles F. Wheeler, secretary-treasurer, Geneva; E. Francis Larham, president, Geneva; William T. Axton, Executive Board, Glenn Falls; Walter A. Knopf, sergeant at arms, Rochester. (Middle row) Rocco Monaco, executive board, Utica; Harvey Spencer, executive board, Little Falls; Walter Scarfe, executive board, Syracuse, and George F. Raaflaub, vice-president, Syracuse. (Bac row) Charles E. Garling, vice president, Geneva; Frederick J. Young, executive board, Niagara Falls, and Frank E. Coniglio, vice-president, Rochester.

New York Projectionists Hold 1960 Fall Meeting

GLEN FALLS, N. Y.—The 1960 Fall Meeting of the New York State Association of Motion Picture Projectionists was held here Oct. 17 at the Queensbury Hotel.

The association members were taken on two tours by Local 524 of Glen Falls. The members visited the Union Bag-Camp Paper Corp., while the Auxiliary was taken on a tour of Fort William Henry.

The afternoon session was devoted to lectures and demonstrations. The New Victoria X 70/35mm projector was shown to members. A lecture was given during the meeting by J. W. Cosby, national sales manager for arc carbon products, National Carbon Company. Cosby's lecture was on the history of the carbon arc and was illustrated with slides and film. A film on uranium was also shown during the afternoon session.

In the evening, the business session was opened by President Larham. The problem of the association's finances was discussed; later, after his re-election, President Larham appointed a finance committee with William Ingram as chairman and H. Paul Shay and Donald Lutton as members. A committee appointed to discuss new by-laws consisted of George Raaflaub, chairman, and Fred Boekhout and John Krebs, members. In his fall meeting report, Charles F. Wheeler, secretary-treasurer, asked member Locals to write him with ideas pertaining to fund-raising for the association.

New officers of the association are: E. Francis Larham, president, Geneva, N. Y.; George Raaflaub, vice president, Syracuse; Frank Coniglio, vice-president, Rochester; E. Charles aGrling, vicepresident, Geneva; Charles F. Wheeler, secretary-treasurer, Geneva. On the executive board are: Rocco Monaco, Utica; Walter Scarfe, Syracuse; Harvey Spencer, Little Falls; William Axton, Glen Falls, and Frederick Young, Niagara Falls. Walter Knopf, Rochester, is sergeant-at-arms.

GREEN DIES

LOS ANGELES—Richard J. Green, general secretary and treasurer of the IATSE from 1924 to 1930, died here September 26. He was a member of two locals, Stage Employes Local No. 2, Chicago, and Hollywood Projectionists Local 165. He got his start as a stagehand with "Doc" Potter's dog vaudeville act.

From

San Francisco
St. Louis
Sacramento
Seattle
Syracuse

Shreveport
San Diego
Salt Lake City
Sao Paulo, Brazil
Salisbury, South Rhodesia

Terre Haute
Tulsa
Toronto, Canada

Rochester
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New Orleans
Norfolk
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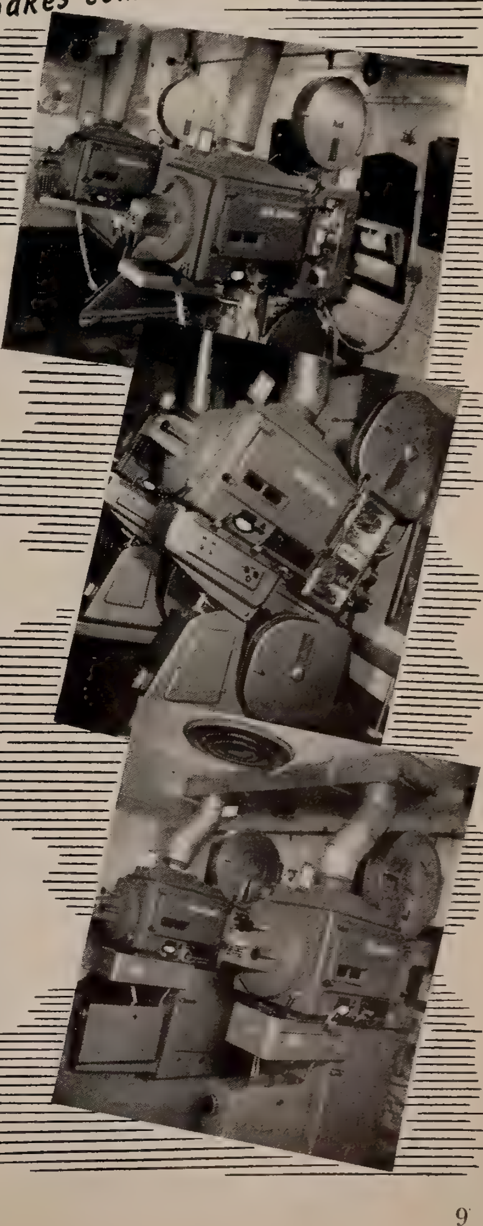
STRONG

Comes the News!

In fact, from all parts of the compass, comes the word that more Strong projection arc lamps are installed for the projection of 70 mm productions than all other makes combined!



The New Strong "35/70 Special" PROJECTION LAMP MEETS THE OPTICAL REQUIREMENTS OF EVERY 70MM/35MM PROJECTOR!

Designed specifically for 70 mm/35 mm projection, it projects both equally as well and without changing reflectors. The only 70 mm arc which accommodates full 20-inch positives. Permits projection of an extra double reel per carbon.

Automatic arc control—

AT NO EXTRA COST!

Strong manufactures nine types of projection lamps. The only complete line. Write for full details. Without obligation, you can have any of them demonstrated in your theatre.

THE STRONG ELECTRIC CORP.

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Intensification Techniques: Topic of SMPTE Congress

NEW YORK—Intensification Techniques were the subject of discussion at the fourth session of the Fifth International Congress on High-Speed Photography at the Sheraton Park Hotel in Washington, D. C.

Bernhard A. Bang of Friez Instrument Division of the Bendix Corporation, Baltimore, Md., opened the session with a paper on "High-Sensitivity Television as an Aid to Low Light Level Photographic Recording."

High-Sensitivity closed-circuit television equipment can be used as an aid to record a scene where the effective exposure limitation is below the capability of direct photography. The monitor presentation is photographed by normal techniques. The effective speed of such systems has been increased rapidly during the past three years. Equivalent ASA ratings in excess of 100,000 are now available. The sensitivity of a well-designed closed-circuit television equipment is determined primarily by the pickup tube and the optics. The most sensitive tube available for the past several years has been the image orthicon or its variations. The sensitivity has been increased to the point that the statistical variation in light photons received is a limitation. The characteristics of these tubes, mode of operation and relative sensitivity care was discussed in this paper.

"Electronic Image Intensifications: Image Intensifier Using Cathode-Conductivity," were discussed at this session by R. A. Chippendale and J. R. Folkes of Associated Electrical Industries (Woolwich) Ltd., Harlow, Essex, England.

"Very High Gain Image Intensifier Systems and the Photography of Single Photons with Microsecond Time Resolution," was the title of a paper presented in this session by Martin Perl and Lawrence W. Jones of the University of Michigan, Ann Arbor.

Michel Clopeau of the Laboratoire de Recherches Electroniques de la Sorbonne, Paris, France, presented the closing paper at this session, "The Printing of Underexposed Photographs by Means of 'Optical Contrasters.'"

Optical contrasters are instruments which are quite particularly intended for the viewing or printing of very much underexposed photographic films or plates. The principle of these special photographic enlargers consists in having the light pass several times through the film, so that the contrast is approximately multiplied by the number of passages effected. In the contraster type A the film is placed between two semi-reflecting plates which are mounted at a very small angle to each other, and illuminated by ollimated light. The emerging light consists of beams which have passed the film one, three, five or more times. Their directions are slightly different so that it is possible to choose any one of these beams. In the contraster type B the film image is reformed on itself by means of an objective-mirror system. Several printing tests prove the efficiency of these instruments which may lead to a systematical improvement of the performance of cameras or the utilization of accidentally underexposed negatives.

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New Electronics Text From McGraw-Hill

ELECTRICAL NOISE. By **W. R. Bennett, Data Communications Consultant, Bell Telephone Laboratories. 288 pages, 6 x 9, 106 illustrations. McGraw-Hill, $10.00.**

How noise originates in electrical circuits, the terms in which it is described, how it is measured, and how circuits may be designed to minimize undesirable effects from noise are presented in this newly published book. It describes in qualitative and quantitative terms the physical nature of various important noise sources, including thermal agitation or resistance noise, shot noise in vacuum tubes and semiconductor junctions, noise from spontaneous emission of electromagnetic radiation, and noise in gas discharges.

Coverage of recent advances includes a treatment of noise in transistors, masers, and parametric amplifiers. Fundamental facts about such devices as junction diodes, transistors, gas discharge tubes, klystrons, traveling wave amplifiers, and nonlinear reactive amplifiers are given as an adjunct to their noise properties. The book also presents a comprehensive review of noise in the various methods of signal transmission such as amplitude modulation, frequency modulation, and the different kinds of pulse modulation.

Further information on Bennett's **Elecrical Noise** is available from McGraw-Hill's Industrial and Business Book Information Service, 327 West 41st Street, New York 36, N. Y.

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CORDER SERVICES

CHICAGO—Services were held here for W. Ray Corder, member of Local 110 of the Chicago Moving Picture Operators Union. Corder resided at 1303 Carmen Ave., Chicago.

JOHNSTONE HONORED—John H. Rowley (left), master of ceremonies at The Theatre Owners of America's national convention presents J. R. Johnstone, president of National Carbon Company, with a gold life-time pass for the theatres of the United States.

J. R. Johnstone Honored by TOA

LOS ANGELES—The Theatre Owners of America, at their recent national convention here, presented a gold life-time pass to J. R. Johnstone, president of National Carbon Company, Division of Union Carbide Corporation.

In making the presentation, John H. Rowley, master of ceremonies and president of Rowley United Theatres of Dallas, said in part, "One of the reasons for the success of TOA's conventions is the support we get year after year from a small group of companies. One of these is National Carbon Company. Head man in our long dealings with National Carbon is J. R. Johnstone, who so many of us know personally as "Rod." The cumulative results of all his efforts are so great that we would now like to say thanks in a little different way."

The gold pass Mr. Johnstone accepted reads, "In grateful appreciation for your friendship and cooperation, TOA presents to J. "Rod" Johnstone, president, National Carbon Company, a gold life-time pass for the theatres of the United States."

The special award is only the second ever made by the theatre owners organization.

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GOLDEN ANNIVERSARIES

NEW YORK—Celebrating their Golden Wedding anniversaries here are 25/30 Club, IATSE, members, Brother and Mrs. Louis Silberstein and Brother and Mrs. Joe Abrams.

Carbon-Arc Lamps For the Space Age

The development of space vehicles and rockets has been helped by the Solar Radiation Simulator, a piece of equipment used in every company or Government agency interested in the space program. Space vehicles use the sunlight as a source of energy in the "sun batteries" which supply the intricate mechanisms of the vehicles with the necessary current. The "sun batteries" are tested on the ground, in the laboratory, with the Solar Radiation Simulator.

This instrument produces a beam of light which has exactly the same power, the same spectrum, and the same divergence as the sunlight in the outer atmosphere. This light is much brighter than the light received from the sun on the surface of the earth. It also contains much more ultraviolet rays. The rays of the sun are not absolutely parallel because the sun is a gigantic source of light. The Simulator reproduces all these conditions for the laboratory.

We are advised by Genarco Inc., of Jamaica, N.Y., manufacturers of high intensity carbon arc spotlights and 3,000 watt slide projectors, that they are manufacturing such Simulators. The source of light is a high-intensity carbon-arc lamp operating with the proper carbons at the correct current density. A quartz optical system produces a beam of collimated (essentially parallel) rays with the same number of watts per square foot as the "solar constant," with the same relative energy, for every wavelength and with the same divergence as the sun rays.

The space vehicles and their components are submitted to the light beam of the Simulator in a chamber with the same temperature and the same vacuum as outer space. According to Genarco Inc. **the carbon arc is the only source of light which can be used to "copy" the sun light above the earth's atmosphere.**

(And, as we projectionists have known for years, the high-intensity carbon arc is the only light source that accurately "copies" natural, full-spectrum sunlight on motion-picture screens!—Ed.) **iP**

NORTON ELECTED

NEW YORK — Benjamin Norton, president of the 25/30 Club, IATSE, was unanimously elected first vice-president of the Society of the Third Infantry Division of the United States Regular Army, during a Division convention in Cleveland, Ohio.


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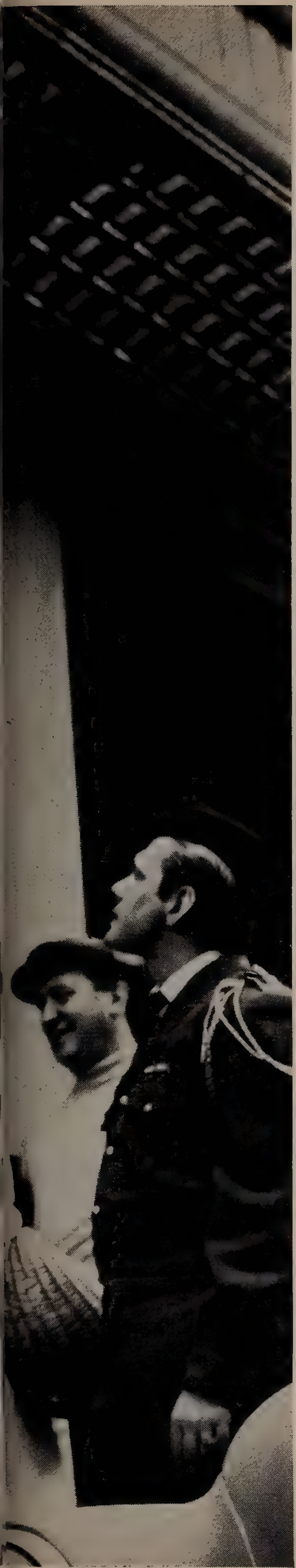


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raised out of sight within a matter of seconds. Also, the five giant stage speaker assemblies behind the screen are equipped with roller castors and can be pushed into specially constructed cubicles off the stage without disconnecting, thus making the complete stage area available for "live" performances in less than two minutes.

Therefore, as well as presenting all which is most modern in cinema entertainment this modern theatre is also able to present "live" shows on the stage. The equipment of the world-famous Strand Electric & Engineering Co. Ltd., London, has been chosen for the stage lighting of this theatre. The entire stage planning and supply and installation of this equipment was put in the hands of their Agents, Messrs. H. A. O'Connor & Co. Ltd. The equipment installed is of the very latest design and consists of a tremendous number of lighting points operating from either the stage or by remote control from the projection room. No matter how large the show at the Palace, the Strand Electric stage lighting equipment will be able to do justice to it.

Closely associated with the stage lighting are the stage curtains and draperies. To ensure that they were in keeping with the best in Katong's new theatre, Glorianna satins were chosen, which we think you will agree present a most luxurious spectacle. Here again, these are a product of Rank Precision Industries Ltd., and were supplied and installed by their Agents, H. A. O'Connor & Co. Ltd.

In accordance with the City Council regulations of Singapore relating to stage performances, the safety of the audience is taken care of by a safety fire curtain. The safety fire curtain installed in their theatre is in itself a remarkable piece of engineering. It completely shuts off the audience from the stage with a steel and asbestos curtain weighing many tons, but in spite of its great strength and weight can be lowered in a matter of seconds. The curtain is also a product of Rank Precision Industries Ltd.

Last, but by no means least, the luxurious seats were manufactured by the Rank Precision Industries Ltd., London being supplied and installed by H. A. O'Connor & Co. Ltd. They consist of the popular "Diplomat" chair already installed in so many of Singapore and Malaya's leading cinemas—clean, comfortable, and of a pleasing design.

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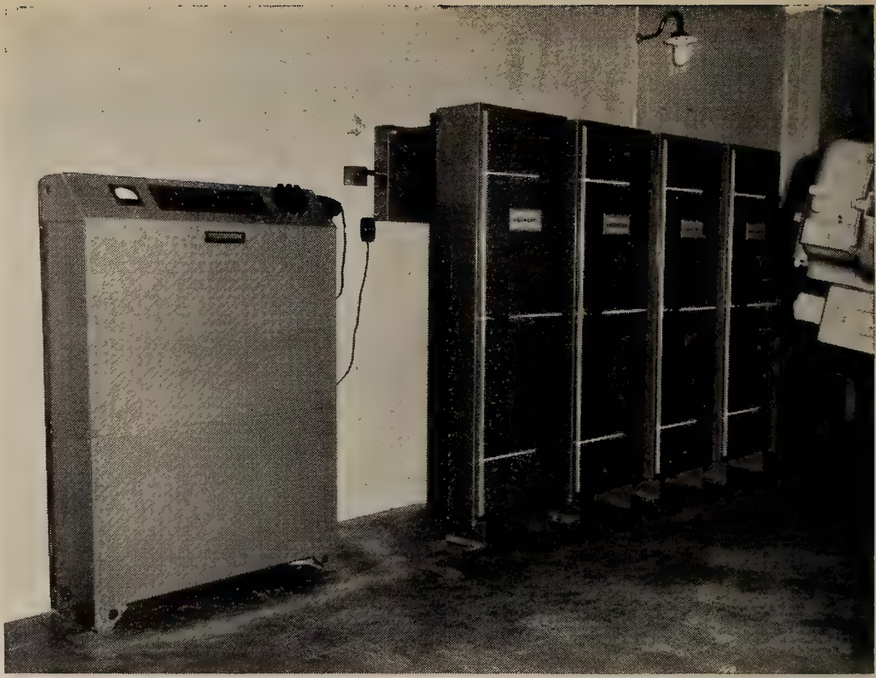

FIG. 4 — The Duosonic power and amplifier cabinets for 70-mm 6-track magnetic sound, 3 or 4-track magnetic CinemaScope sound, and 1-track optical sound with provisions for the Perspecta Sound stereophonic process.

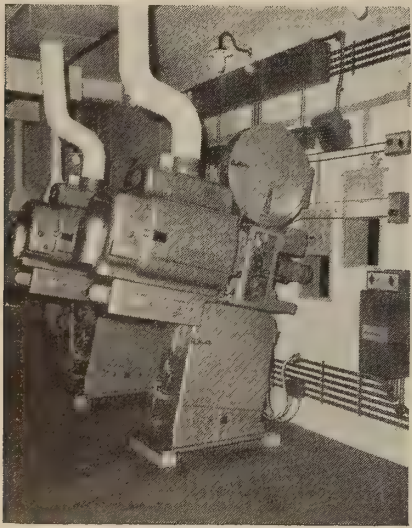

FIG. 3 — This spacious booth with its ultramodern equipment is truly a projectionist's dream! The projectors are Cinemeccanica 70/35-mm Victoria X's, and the arclamps are Glaumont-Kalee Super Zenith high-intensities. Note the simplicity of the controls in this Singapore booth where every conceivable 35-mm and 70-mm sight-and-sound process can be handled.

Bausch & Lomb has New 70mm Lenses

A new Bausch and Lomb optical system for 70-mm projection was used for the West Coast premiere of Bryna's "Spartacus," at the RKO Pantages Theatre.

This new Bausch and Lomb design permits the exhibitor to take full advantage of the high quality of production which has been achieved in the film.

Advantages of this new system, according to the company, are:

1. Excellent depth of focus.
2. Extreme flatness of field.
3. Uniform screen illumination.
4. The new lenses are smaller than most lenses used for professional 35-mm projection.

The Bausch and Lomb lenses used for the "Spartacus" premiere and a uniquely different 35-mm design introduced last month at the New York Premiere of "Sunrise at Campobello" are the first two such sets of Bausch and Lomb lenses in the world. **iP**

Handbook Describes New Projector

AUSTIN, TEXAS — "The Opaque Projector," tenth in the University of Texas' Visual Instruction Bureau's series of visualized handbooks entitled "Bridges for Ideas," has been released for distribution.

Prepared by Dr. Kenneth L. Bowers, associate in the bureau's production department, "The Opaque Projector" describes the use of this equipment in general, with special suggestions for its use in various areas of education.

The booklet explains the nature of the opaque projector, listing its advantages and enumerating its uses. It discusses the preparation of materials for projection and how to plan a presentation. Also included are procedures for care and maintenance, and a selected bibliography of books, periodicals and bulletins.

ARC CONTROLS

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One of the first HI projection arc-lamps to be used in American theatres was the 75-amp. General Electric lamp of 1921. This was a condenser-type lamp having the positive carbon facing the condenser lens squarely, and the negative carbon inclined at an angle of about 55 degrees. The positive carbon rotated as it advanced; and the burner mechanism closely resembled such later American HI condenser lamps as the Peerless Hycandescent and the Brenkert A4 Supertensity in all essential respects. Although serviceable in their day, condenser-type HI lamps have been rendered obsolete by the later and more efficient reflector lamps.

The rapid burning of HI carbon made an automatic motor-driven feed an absolute necessity even in the 75-amp. GE lamp. But with the advent in 1922 of reflector-type lamps, both high- and low-intensity, automatic feed devices became an accepted "built-in" feature of all lamps. Reflector lamps are optically more critical than condenser lamps, and tolerate far less variation in the position of the positive crater.

Now, there are two principal types of arc-control mechanism; and these are distinguished by the method employed to control the carbon-feeding action of the drive motor. These two basic types are illustrated in greatly simplified form in Fig. 1.

Although the "relay type" of control employing an electromagnetic relay switch was very widely used on LI reflector arcs (e.g. the Peerless and Motiograph), the "continuous type" of control having a motor regulated by the current flowing through the arc was originated by Harry Strong, and has been used in most Strong reflector lamps. This type is used by all manufacturers of Suprex, or "simplified high-intensity," reflector arclamps.

Arc Drop Regulates Motor Speed

If a series motor which is geared to the mechanism of an arclamp is connected across the arc, it is obvious that the motor will receive more current, and thus run faster, as the carbons burn apart. The resulting increased motor speed feeds the carbons closer together, shortening the arc gap and decreasing the voltage drop. This causes the motor to run more slowly, or to stop altogether, until the arc gap again increases.

There are several ways to connect a "continuous-feed" motor to the arclamp circuit. If the motor has but a single field, the motor is shunted across the arc. Closer control is sometimes obtained with a second field winding of very heavy wire connected **in series** with the arc. Because this winding receives more current with a shortened arc gap, it is wound to **oppose** the magnetic action of the main field winding of fine wire shunted across the arc.

A rheostat in the shunted field winding permits the overall speed of the motor to be regulated by the projectionist to maintain the correct gap length for the carbons and current employed. The wiring of a continuous-feed control of this type (Ashcraft) is shown in Fig. 2.

The carbons of a LI reflector arc are consumed so slowly that there is very little "creeping" of the arc toward or away from the lamp mirror during the

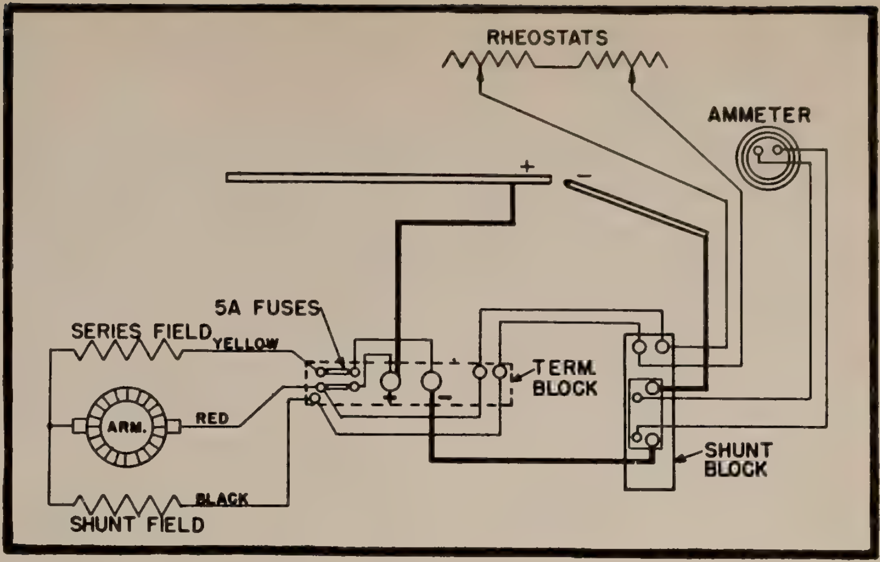

FIG. 2—Actual hookup of a continuous-type arc control as employed in the Ashcraft Superpower high-intensity arclamp.

burning of a recommended trim. The LI trims recommended by the carbon manufacturer are chosen so that the positive and negative carbons are consumed at the same rate — so many inches per hour for each carbon. Thus a 13-mm positive and a 9-mm negative constituted a suitable trim for a current of 40 amps. and an arc drop of 55 volts in LI reflector lamps. The absence of arc creeping made a separate negative-feed adjustment unnecessary in lamps of this type.

Arc "Creeping" in HI Lamps

The problem of arc "creeping" became painfully evident with the general adoption of Suprex HI lamps having coaxial trims and non-rotating positives. These are the "simplified HI" arcs which are sometimes anything but simple to operate!

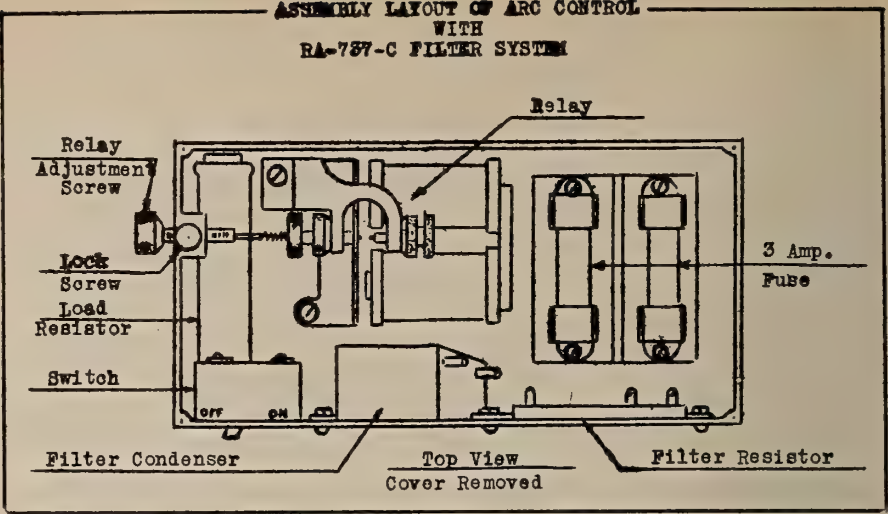

FIG. 3 — Diagram of the relay-type control mechanism of the old Motiograph low-intensity reflector arc. The filters prevent the spark noise of the relay from being picked up by the sound system. The Peerless LI reflector-arc control mechanism was very similar.

Despite the use of recommended trims of copper-coated HI carbons, and regardless of the length of arc gap employed, the entire arc, in certain lamps of this type, would slowly creep toward the mirror if the current was a few amperes higher than the norm (increased positive consumption), or away from the mirror if the current was a few amperes lower (decreased positive consumption). In other words, the relative burning rates of HI positive and negative carbons are greatly affected by the value of the current employed.

Creeping of the arc is the chief cause of the annoying change in the color of the light at changeovers. When the positive crater is too close to the mirror, the light is yellowish or brownish; when too far away, violet or bluish. It is generally impossible for projectionists working with certain older Suprex lamps to maintain identical focus conditions in both lamps simultaneously at the time of changeover, hence the abrupt change in the color of the screen illumination.

The only sound solution of the problem of arc creeping in HI lamps was the use of some means of speeding up or slowing down the negative feed rate relative to the positive feed rate. All the better makes of Suprex reflector lamps are accordingly equipped with a clutch device to vary the speed at which the negative carbon advances.

When using these lamps, the projectionist first adjusts the arc-control motor rheostat to maintain a constant position of the positive crater on the arcoscope card, and afterward he adjusts the negative speed clutch if the arc gap is seen to shorten or lengthen during the burning of a trim. Careful regulation will keep the positive crater "on the nose" and the arc gap constant in length. However, unavoidable fluctuations in current and variations in carbons will make manual correction of the arc necessary from time to time.

It is unfortunate that thousands of theatres are equipped with simplified HI arclamps not fitted with any means of regulating the negative rate relative to the positive. These lamps exasperate the projectionist, who must maintain a constant current by manipulating the field rheostat of the generator or the output taps of the rectifiers, if these are used. If he boosts the amperage to compensate for a dense print, his arcs begin to run a sort of chariot race. And if he fails to prevent arc creeping by this stratagem, he must monkey with the taps of the ballast rheostats or experiment with odd sizes of negative carbons in the hope of finding a size that will make the arc "stay put" on the arcoscope-card lines.

Relay-Type Controls

Let us now stroll down Memory Lane to the days when the Peerless low-intensity reflector arc, made by the old McAuley Mfg. Co. in Chicago, was a very widely used lamp. Like many similar LI lamps, the Peerless made use of the relay-type arc control diagrammed in the left-hand panel of Fig. 1.

There is a good reason for this excursion into the past. In greatly modified and improved form, the relay arc control is the basis of many of the **optically actuated** automatic crater-positioning arc controls used in HI lamps of the most modern design.

In the old LI reflector arcs, however, the relay was actuated, not by light or heat radiation, but by an electromagnet connected across the arc. As the carbons burned away and the gap in-

(Continued on Page 20)

MISUNDERSTANDING

. . . Continued from Page 7

personally witnessed a side-by-side comparison test of single and double-shutter mechanisms on the screen of one of the larger downtown New York theatres which revealed in a most spectacular manner an advantage of double-shutter mechanisms which has unfortunately been overlooked by many projectionists, yours truly included. Let me describe this test before going on to other matters I wish to clear up.

Blank light was projected upon the screen alternately from two of the four projectors. One of these machines had a very efficient single shutter, the other a double disc-type shutter. The high-powered arclamps were supplied by rectifiers. When the single-shutter mechanism was flashed on the screen, the expected flickering of the field of blank light was clearly evident. But when the changeover was made to the double-shutter machine, the shutter-flicker effect virtually disappeared! I was really "bowled over" by the almost perfect absence of flicker; and I am willing to bet that no flicker would appear even in the brightest highlights of a picture projected with the double disc shutter machine. The difference in light transmission of the two machines was so small, however, that it could be detected only with difficulty.

This means that all shutters having a double cutoff action—the Motiograph cylindrical, the Brenkert 80 double disc shutter, and the double disc shutter employed in another mechanism of the most modern construction —have much of that prized advantage of 3-blade shutters, namely, the virtual absence of flicker even at very high light levels.

I assume that the same advantage is also obtained with such front-and-rear shutter mechanisms as the Simplex E-7 and the RCA Brenkert 62, although the front component of these machines must be removed to accommodate CinemaScope anamorphic lenses.

I witnessesd this remarkable demonstration only by the merest chance—I happened to phone a projectionist friend on a recent visit to New York; and the topic of shutters came up in our conversation. He kindly invited me to drop in at his theatre to see this side-by-side comparison of shutters—a rare opportunity to get at the facts of shutter performance. Now, the reduction of flicker by double shutters is a psychovisual "effect" which is not even mentioned in such classical scientific discussions of the shutter-flicker problem as Arndt's "Die Flimmergrenze beim Kinobildwerf" ("Limiting Factors of Flicker in Motion-Picture Projection") and Hatschek's "Die Marbesche Flimmertheorie" ("The Marbe Flicker Theory"), both in the pre-war **Kinotechnik.**

Now to go on to other sensitive areas in my August and September shutter articles.

Another misconception, and one for which I am eager to take all the blame, is the statement in the September article that the driving gears of double-disc shutters are apt to become noisy. Although isolated instances of noise in this and other types of shutter have cropped up in IP's mailbag and in nearly every projectionist's personal experience from time to time, a well-constructed double shutter which is properly maintained according to the manufacturer's instructions does not necessarily develop more noise than other well-constructed and properly lubricated shutters—or any noise at all! This is particularly true of the double disc shutters of the most modern construction; and these up-to-date curved-gate mechanisms should not be blamed for operating defects noted on obsolete mechanisms of other types.

Not the least important bone of contention, judging from inquiries which have arrived from projectionists who

obviously favor one particular brand of 35/70-mm machine, is my statement in the September issue of IP, p. 6, that "low-priced 35-mm projectors which have been adapted for 70-mm service at minimum cost"—bootleg mechanisms from which the original manufacturer's serial numbers have been ground off—retain certain obsolete features of these nondescript, privately produced machines, and, of course, require separate units for the soundheads.

Projectionists operating on single-unit European machines approve this opinion; but we regret to inform them at this time, as we unfortunately failed to make clear to all readers of IP in the September issue, that an adapted "economy" mechanism made thirty years ago is not a modern 35/70-mm machine which may also employ separate picture and sound-reproducing units, **but for entirely different reasons, and not because the manufacturer was "forced" to employ this type of construction.**

In fairness to all concerned we must emphasize that a certain modern American 35/70-mm machine **is not** an adapted 35-mm projector. This machine is of extremely rugged and accurate construction, and originally designed to handle wide-gauge film. It bears no resemblance to "economy" revamps of early talkie vintage which have been fitted with bootleg sound reproducers turned out or rebuilt by God-knows-who, God-knows-where! True, the superb machine we have in mind was first offered for 35-mm use (and it still is!); but **from the very beginning** it was made with all the many requirements of 70-mm projection in mind.

Different projectionists have different equipment preferences. I know that I do! But to be honest with ourselves we must admit that each different brand and model has advantages peculiar to itself, the quality of workmanship being equal. As far as the separate-unit construction of a modern American 35/70-mm projector is concerned (NOT an "adaptation," we repeat), projectionists favoring it are quick to point out that it is less complicated to operate and threads up in the "straightforward" manner which is approved by the rank and file of American projectionists.

Who can argue against the premise that the single-rotor conical shutter used in a European 35/70-mm projector is the most efficient of all as regards light transmission? Likewise, who can contradict the demonstrated fact that a double-shutter American 35/70-mm machine has the advantage of nearly flickerless projection? And the lists of advantages possessed by these and other 35/70-mm machines are long.

So, you see, different points of view are very much in evidence at every turn; and it is a source of sincere regret to me whenever I, through carelessness or error, am guilty of fostering misconceptions. It is my duty to correct them when brought to my attention, just as it is IP's editorial duty—now as always in the past—to report the truth to the best of its ability. We are always hearing a great deal more from industry sources than we can ever bring ourselves to believe; and half our job is to avoid being "taken in" by parties with axes to grind. This is **your** magazine, Mr. Projectionist, it operates solely on your behalf, and is beholden only to you.

iP

RCA Sales, Ads Under R. H. Coffin

Radio Corporation of America, New York, has effected a consolidation of its institutional and staff advertising and sales promotion activities under R. H. Coffin as staff vice-president.

Coffin will have responsibility for coordinating policy on both product and institutional advertising and will report to Kenneth W. Bilby, vice-president, Public Affairs.

An advertising excutive for more than two decades, Coffin joined RCA in 1949 and served as director of advertising of the former RCA Victor Division until 1954. He then became director, advertising and sales promotion of RCA, and in 1955 a vice-president of the corporation.

Before becoming associated with RCA, Coffin had been an account executive of McCann-Erickson, Inc.

Fourteen Made SMPTE Fellow Members

NEW YORK—The Society of Motion Picture and Television Engineers has raised fourteen of its members to Fellow Membership Status this year. They are:

Robert C. Rheineck, chief engineer, film production department, CBS News, New York City. Reineck has been a member of the Society for 15 years. Sigmund J. Jacobs, senior scientist, research department, the Naval Ordnance Laboratory, White Oak, Silver Spring, Md. Edward P. Ancona, Jr., who is associated with the National Broadcasting Company in Burbank, Calif. A member of the SMPTE for twelve years, Ancona is a graduate of the University of New Mexico. George C. Higgins, associate head of the physics division, Eastman Kodak Company Research Laboratories, Rochester, N.Y. Fred J. Scobey, technical director, General Film Laboratories Corporation, Hollywood, Calif. Eldon Moyer, retired senior development engineer, Eastman Kodak Company, Rochester, N.Y. Morton Sultanoff, chief detonation section, Ballistic research laboratories, Aberdeen Proving Ground, Md. He is a ten-year member of the Society. John R. Turner, supervisor, equipment development, color technology division, Eastman Kodak Company, Rochester, N.Y.

Richard S. O'Brien, director, audio and video engineering, CBS Television Network, New York City, who received the SMPTE Journal Award in 1955 for an original technical paper.

Neal G. Keehn, regional vice-president, General Film Laboratories, central division, Kansas City, Mo. Hubert Schardin, director, the German-French Research Institute, St. Louis, France. Jerome C. Diebold, executive producer, Wilding, Inc., Chicago, Ill. He is a ten-year member of the SMPTE.

Richard E. Putnam, manager, studio and industrial television engineering, General Electric Company, Syracuse, N. Y. Charles W. Wyckoff, research engineer, Edgerton, Germeshausen and Grier, Inc., Needham, Mass. He has been a member of the Society for eleven years.

WIL-KIN DISTRIBUTOR

NEW YORK — Century Projector Corp. has announced the appointment of the WIL-KIN Theatre Supply Co. as exclusive distributors in the Atlanta, Georgia film territory of Century American-made 70/35mm Projectors and Transistorized Magnetic-Optical Sound Systems and Century Standard 35mm line of theatre projectors and transistorized sound systems.

MONTHLY CHAT

... Continued from Page 3

equipment even though he wishes that his present equipment were more modern. From the standpoint of simple accounting, he often cannot afford new projectors and lamps — and this despite the inescapable fact that he also cannot afford to offer his patrons anything less than the best projection if he wants to stay in business!

In 1952 or 1953 he bought 3-D equipment — motor interlocks, polarizers, oversize film magazines, and seamy, aluminized screens—and it's all useless.

He bought CinemaScope stereophonic soundheads, amplifiers, and speaker units, and he can't get a 4-track magnetic print.

He bought several different screens of every type of surface and depth of curvature recommended by the studio pandits — and now he realizes that he should have installed a flat white screen.

He recently bought 70-mm equipment and a 6-channel sound system only to see the release of the widefilm "super attractions" in the form of 35-mm prints—and the unhappy standardization of 24 frames per second for 70-mm film, thus insuring quick release of these pictures as 35-mm prints to theatres where not a penny was invested in costly widefilm equipment.

Hollywood, Author of Confusion

The exhibitor has been barraged by producer propaganda in favor of 55-mm prints, horizontal 35-mm prints with and without various amounts of anamorphosis, and several other projection and sound-reproduction processes which can only be described as "off-standard." He has been subjected to similar pressure to purchase expensive TV projection apparatus which would of necessity have remained unused most, if not all, of the time.

The exhibitor is confused by the Hydra-headed dilemma of 70-mm versus 35-mm prints — just as he was (and to some extent still is) bewildered by the "battle of the aspect ratios," by the matter of screen curvature, and by the question of magnetic versus optical sound, single-channel versus 3, 4, or 6-track magnetic, single-channel optical versus the Perspecta Sound stereophonic process, etc.

The exhibitor doesn't know so he buys nothing. The fault is not his, but Hollywood's.

The Hollywood producers and their technicians are guilty of having time after time advanced a multiplicity of processes for accomplishing practically identical end results. A dozen different ways of widening the screen and of reproducing stereophonic sound were thrust upon the industry without a single attempt by the Academy or the SMPTE to choose one method above all others or to obtain agreement on new-process standardization **before** commercial application. Each studio had only to invest in its own pet process, but the poor exhibitor was forced to install equipment for all of them — 3-D, anamorphic widescreen, non-anamorphic widescreen, magnetic sound, optical Perspecta Sound, synchronous soundtrack film phonographs, horizontal VistaVision, horizontal Technirama, 55-mm film, 70-mm film, etc. Every 35-mm projection room is still cluttered by a variety of aperture plates, lenses, anamorphic attachments, and amplifier channels. Where 70-mm apparatus is also present, the confusion is staggering.

Can the average movie patron tell the difference between all these different processes by looking at the picture on the screen? In the case of the different widescreen processes he cannot except by careful observation.

New 35-mm Units Mandatory

One sure fact endures in this Bedlam of aspect ratios and this Babel of soundtracks, namely, the 35-mm projection process with optical sound is here to stay no matter what else we may eventually have. Both CinemaScope and regular-type picture images will be used for many years.

It is a certainty that 35-mm film and equipment will be the mainstay of motion-picture exhibition regardless of the future of widefilm processes.

And regardless of the initial form of a picture, rest assured that it will ultimately be released in the form of a 35-mm print with optical sound.

The exhibitor who knows this much and agrees with us projectionists that nothing less than the very best projection and sound are acceptable today will no longer be confused and uncertain when confronted with the equipment problem. When the sound is less than high-fidelity, or the picture on the screen is dim, unevenly lighted, fuzzy, flickery, or not absolutely rocksteady, the standard 35-mm projector mechanisms, lenses, lamps, rectifiers, soundheads, amplifiers, and stage speakers should be updated **without waiting to see what happens in the field of 70-mm prints or stereophonic sound.** The purchase of modern 35-mm equipment is not a gamble: it is a necessary investment.

Projectionists the Real "Buyers"

So, you see, the matter of equipment updating is fundamentally as simple as its need is urgent. The screens of most theatres are crying out for brighter, sharper, steadier, more lifelike pictures! And the projectionist must "sell himself" on the need for truly modern 35-mm projection and sound units before the exhibitor will buy.

As we have said many times before, it is the duty of the projectionist to **know** all types of equipment, to **urge** the replacement of obsolete and defective units, and to **aid** the exhibitor in the selection of the brands and models best suited to each individual theatre. Nine times out of ten it is the projectionist who really does the "buying" of projection equipment — he is the expert in these matters, and the astute exhibitor knows this. R.A.M.

iP

70MM THEATRES

NEW YORK—As of August 31 there were 152 theatres in the United States equipped to show 70mm films. At that time 15 new installations were under way and 51 more are in the offing.

In the Toronto area there are 15 wide screen installations in operation and another is planned.

About 300 theatres, including those in foreign countries, now have the 70 mm projectors, says George Skouras, president of Magna Pictures.

A large share of the U. S. installations are around Boston, Los Angeles, New York and Washington. Boston has four and Los Angeles seven. These include Beverly Hills and Hollywood. Seven of 12 houses in New York are in the Broadway area. They are: Rivoli, State, Criterion, Warner, DeMille, Capitol and Astor. Except for the Murray Hill, a Rugoff & Becker house, the others are in suburban areas.

Minneapolis has four completed and one contemplated.

New Carbon Saver In Lou Walters' Line

DALLAS—Lou Walters, whose projector repair service is headquartered here, has added the 9-mm size to his carbon saver line, rounding out all the sizes used in rotating lamps.

"This new saver has been widely accepted in all parts of the country," Walters said, "mainly because of the trouble-free design. No drilling is necessary and no tools are required to use the saver. It is the most simple process ever designed to save carbons and it does just that in saving several hundreds of dollars per year in booth operating cost."

Further information about the new saver may be secured by writing to Lou Walters, 8140 Hunnicut Rd., Dallas 28.

ARC CONTROLS

. . . Continued from Page 16

creased in length, the current in the electromagnet coil also increased and closed a magnetic switch which worked against a tension spring. When the switch was closed, current was allowed to flow through the drive motor which brought the carbons closer together. The resulting decrease in the arc voltage drop then opened the relay and shut the motor off.

In order to prevent large periodic variations in gap length, the contact points of the magnetic relay switch were usually shunted by a resistor which kept the drive motor running slowly even when the relay was open. The projectionist could adjust the gap length by means of the relay tension-spring screw. Fig. 3 is a diagram of a relay arc control made for LI lamps.

Strong "Lightronic" Control

If, instead of depending upon the arc voltage drop to actuate a relay which turns the carbon-feeding motor on and off, an optical image of the positive crater upon a radiation-sensitive cell is pressed into service to perform the same chore, astonishingly accurate control of the arc can be obtained. There are two general methods of optical control.

One of the most satisfactory of all is the use of a bi-metal switch which turns the feed motor on or off depending on whether the bi-metal strip is heated by the crater image or not. This is the method which forms the basis of the extremely accurate Lightronic arc-control system built into such modern Strong lamps as the Mighty 90, the Super 135, the 35/70 Special, and two models of the U-H-I, a favorite "big-screen" arclamp.

Earlier versions of the optical arc-control system employed a single feed motor for both carbons, with a variable-speed clutch for adjustment of negative feed rate and the maintenance of a constant gap length. The Strong Lightronic arc control, illustrated schematically by Fig. 4, employs two separate Bodine-geared motors, one for each carbon, to maintain a uniform gap length and to keep the positive crater exactly in the focus of the reflector regardless of carbon idiosyncrasies and minor current fluctuations. A screen light of constant intensity and color — a mighty important point to consider — is automatically maintained without constant attention from the projectionist.

The Murch Optical Method

The second method of optical arc control depends upon the width of the light beam thrown toward the projector mechanism by the arc mirror. This method also makes possible precise control of the crater position, but differs from the Strong Lightronic system in that spot adjustment is impossible without disturbing the adjustment of the optical control. The replacement of mirrors also necessitates a readjustment, or at the very least a recheck, of the control.

This remarkable system, which picks up light from the edge of the beam reflected by the mirror, was first seen by the writer in a prototype HI arclamp designed and built by Charles Murch of the Murch Electric Co., Franklin, Maine, in 1954.

The edge of the reflected light beam is intercepted by a small mirror and directed to the sensitive plate of a control cell, either photoconductive (selenium) or photoeletric (cesium). The original Murch lamp employed a regular soundhead photocell and a simple vacuum-tube amplifier.

Should the positive crater advance toward the mirror, the beam of light reflected by the mirror becomes slightly wider and results in stronger illumination of the light-sensitive cell. This causes the feed motor to stop, if a relay is used, or to slow down, if the amplified cell output continuously influences the strength of the magnetic field in the motor windings, until the crater burns back to the point of correct focus.

Conversely, if the crater recedes from the mirror, the light-sensitive cell gets less light because the beam has been slightly diminished in diameter. The cell then turns the motor on (relay-type drive) or speeds it up (continuous-type drive) and advances the carbon until the correct position of the crater has been restored. The Strong Lightronic system is more direct from an optical point of view, but both methods accomplish the same results and are capable of an accuracy of crater posi-

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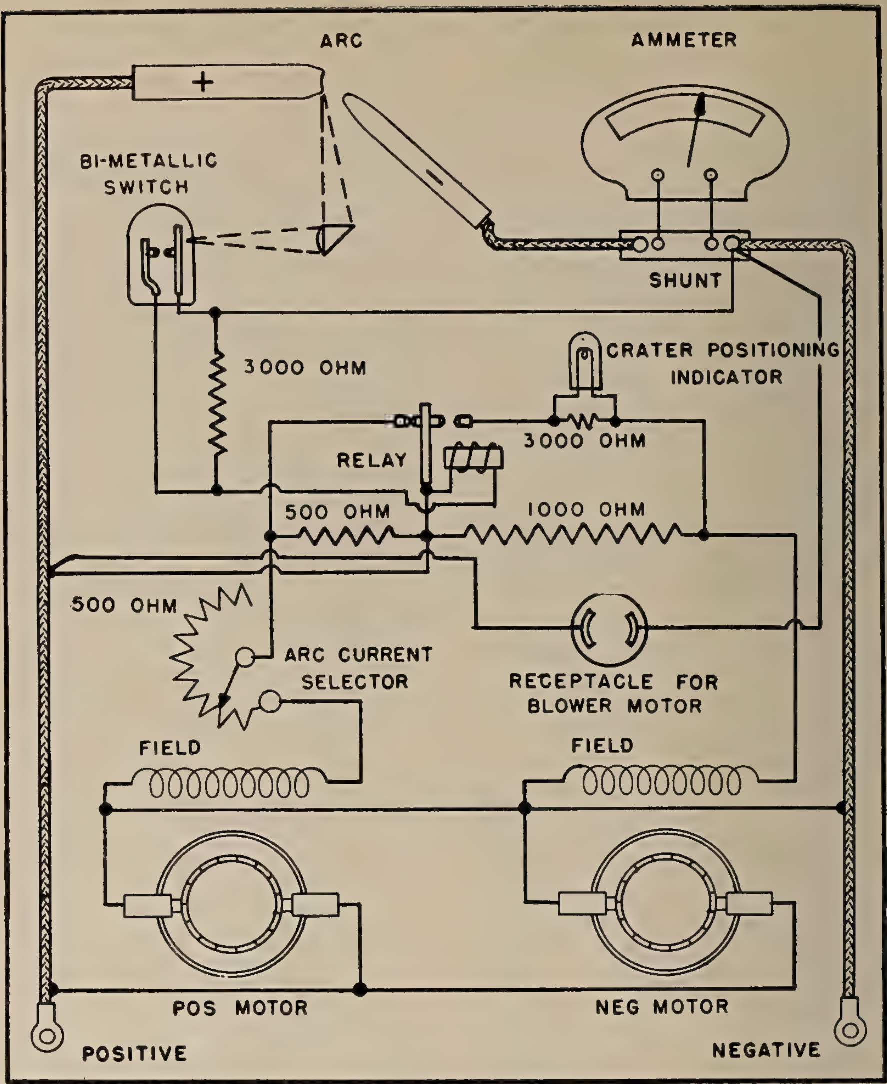

FIG. 4 — Wiring diagram of the Strong Lightronic arc control employing two feed motors and a bi-metal optical cell for positioning of the positive crater. This is said to be of the most advanced, accurate, and trouble-free carbon-feed and crater-positioning mechanisms for high-intensity projection arclamps.

How to Acquire a Permanent Savings Habit in Minutes

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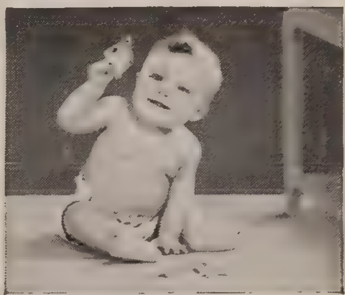


You don't lose a penny if your Bonds are lost or destroyed. Since 1941, 1,300,000 Bonds have been replaced by the Treasury Department at no cost to the owners.

ARC CONTROLS

. . . Continued from Page 20

tioning within a few thousandths of an inch.

These modern carbon-feeding and crater-positioning devices are a far cry from the hand-feed knobs of the old "tin-Lizzie" vertical arcs of the nickelodeon "flickers." They are even a big improvement over the best arc controls found in Suprex-type lamps. And thus we are once again reminded that modern movies demand modern projection equipment, to which we add the self-evident observation that modern projection is impossible without the close optical control of the arc obtainable only with the latest rotating-positive HI arclamps. **iP**

Reid H. Ray Elected SMPTE Vice President

WASHINGTON, D. C.—Following the Fifth International Congress on High-Speed Photography, sponsored by the Society of Motion Picture and Television Engineers, the announcement of the election of officers of the sponsoring Society was made. Reid H. Ray, president of Reid H. Ray Film Industries, was elected executive vice-president for a two year term.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, JULY 2, 1946 AND JUNE 11, 1960 (74 STAT. 208) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF INTERNATIONAL PROJECTIONIST

Published monthly at Main Postoffice, Minneapolis, Minnesota for October 3, 1960.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Frank W. Cooley, Jr., Minneapolis, Minn.

Editor Frank W. Cooley, Jr., Minneapolis, Minn.

Managing editor, Ray Gallo, New York, N. Y.

Business manager, None.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1% or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

Northern Publishing Co., Minneapolis, Minn.
Frank W. Cooley, Jr., Minneapolis, Minn.
Rita Cooley, Minneapolis, Minn.

3. The known bondholders, mortgagees, and other security holders owning or holding 1% or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

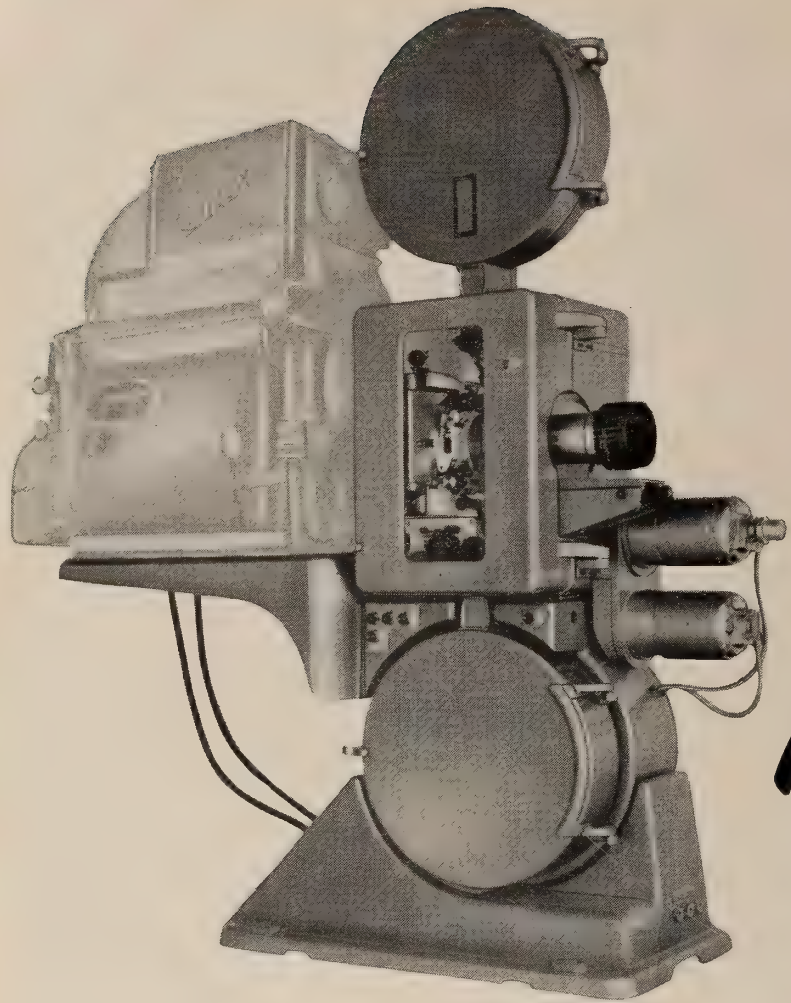
4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required by the act of June 11, 1960 to be included in all statements regardless of frequency of issue.) 6982.

F. W. COOLEY, JR.

Sworn to and subscribed before me this 12th day of October, 1960.

D. M. VOLK
Notary Public, Hennepin County, Minn.
My Commission Expires Feb. 27, 1967.



a few facts for projectionists about the

Norelco®

Serving Science and Industry

UNIVERSAL 70/35mm PROJECTORS

PROJECTIONISTS who have been operating Norelco Universal 70/35mm projectors (over 200 theatres already have them!) are unanimous in their reports that it's a smooth running, reliable mechanism. The big difference is that the Norelco 70/35 was designed from the ground up specifically for 70mm/35mm projection. It is not an adaptation of a 35mm machine. Conversions from 70mm to 35mm take less than 4 minutes and runs as high as 1500 per print are being reported by theatres!

The following check list will help you become familiar with a few of the outstanding features of the Norelco Universal 70/35 Projector:

• Fully compatible with, and quickly convertible for: 70mm or 65mm film with up to six magnetic sound tracks; 35mm CinemaScope with four magnetic or single optical sound tracks, and Perspecta-Sound, Wide Screen film of any aspect ratio with either magnetic or optical sound and standard 35mm film. • Scientifically compounded curve of light gate—prevents film buckle. • Single blade, double speed conical shutter, providing highest light transmission of any projector. Leading and trailing edges have integral air scoops that aid in dissipating heat. • Rollers, drums, sprockets and film gate made from non-magnetic materials—eliminates possibility of magnetic sound track damage and necessity for frequent degaussing. Dual sprockets on all shafts machined of hardened aluminum alloy. No sprocket change required when changing from 70mm to 35mm or vice versa. (Less than 4 minutes required.) • Two independent motors on each projector, 24 and 30 fps—all past, present or contemplated 70mm films can be projected without additional expense or modification. • Combination ten-track magnetic clusters, no tricky threading required when changing from six- to four-track reproduction. • Triple filtered metered lubrication system. • Substantially constructed for rock steady projection. • All modern domestic high-power arc lamps adaptable without loss of efficiency. • Lathe bed lens carriage, positive alignment of lens to film path. • Factory installed internal wiring, reduces installation costs. • Adjustable for all projection angles—from 28 degrees downward to the upward angles required in drive-ins. • Complete stock of replacement parts always available. • Full Underwriters' Laboratories Approved.

Norelco projection equipment is now available through your favorite theatre supply dealer.

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MOTION PICTURE EQUIPMENT DIVISION
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INTERNATIONAL PROJECTIONIST

DECEMBER 1960

VOLUME 35 NUMBER 12

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May the Joy and Goodwill of the Christmas Season light the way for us all to a fine New Year of Peace and Progress

INTERNATIONAL PROJECTIONIST

Including a special Audio-Visual section relating to the operation and maintenance of A-V equipment in the educational and industrial fields.

Volume 35 Dec. 1960 No. 12

EAST COAST OFFICE
545 Fifth Avenue
New York 17, N.Y.
Murray Hill 7-7746

RAY GALLO
General Manager

MIDWEST OFFICE
4616 Washburn Avenue South
Minneapolis 10 Minnesota

FRANK W. COOLEY, JR.
Editor and Publisher

R. ENTRACHT
Associate Publisher

RAY GALLO
General Manager

R. A. MITCHELL
Technical Editor

In This Issue . . .

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MONTHLY CHAT

At Year's End — Exhibition at the Crossroads

JOLLY OLD ST. NICK is obviously not a product of the democratic tradition. For if he were completely impartial, distributing his favors to all, he would not confer his boons upon the tiny tots exclusively.

No one will object to that corpulent saint's miraculous descents down chimney flues with his sack of Yuletide delights for the youngsters; but there are children of larger growth who would also benefit by a largesse as fabulous as that of Santa Claus. The theatre projectionist, for instance.

It would indeed be a merry Christmas for the average projectionist should a film-loving Santa Claus clamber down the projection-room ventilating pipes with a pair of modern mechanisms, or somehow, by magic, negotiate a couple of high-powered arclamps via the same route. Christmas is truly the season of marvels; but the "unseen showman"—the forgotten man in the projection room—is likely to get the short end of things in December as in July.

Even more unlikely than gifts of new booth equipment from St. Nick's workshop at the North Pole, it saddens us to realize, is the installation of adequately up-to-date projection and sound-system units by the average theatre owner. As a matter of fact, many projectionists would settle for a "Christmas present" of the replacement parts he urgently needs to forestall a complete breakdown of the obsolete junk equipment which all but murders modern high-definition color prints and high-fidelity soundtracks.

Yes, it is far more probable that the projectionists in the average theatre will discover new arc mirrors and new sprockets, gears, and amplifier tubes left under their Christmas trees by Santa Claus, himself, than that these necessary items will be voluntarily offered by the exhibitor whose prosperity—**nay, whose very existence in the exhibition business**—depends largely upon the quality of the picture on the screen!

What is the reason for this strange hedging of the average exhibitor in meeting the necessary costs of operation? Why this deplorable betrayal of the producer's best efforts and the trust of the moviegoing people? Are bad business conditions the reason? Hardly!

The 10-year decline in theatre attendance in the United States ended abruptly in mid-February 1959. During the week ending May 30, 1959, attendance had climbed to more than 15% over the same period in 1958, according to Sindlinger & Co., business analysts.

Still later, the U. S. Department of Commerce reported an **overall** increase in boxoffice receipts of 4.3% over 1957 for 1958, and between 7% and 8% over 1958 for 1959. More recent samplings indicate an even more spectacular rise for 1960.

The 2-year period of 1958-1959 saw 116 new drive-in theatres constructed in the United States, 57 new indoor theatres, and 907 reopenings of theatres which had previously closed—a total of 1080 showplaces.

Is this "bad business"? It is actually better business, considered as per cent of growth, than has been experienced in many larger, and more basic, industries. In these times when the public is returning to the theatres in droves, and is finding in theatre films its best and most satisfying audio-visual entertainment, "bad business" is a bad excuse for bad management.

(Continued on Page 18)

INTERNATIONAL PROJECTIONIST

Volume 35 December, 1960 Number 12

Projection Quality and Release Prints

By ROBERT A. MITCHELL

IP's oft-repeated admonition that "if it isn't on the film, it can't appear on the screen" is given a reverse twist in this article: "If defects are present in the print, they'll appear on the screen bigger than life, and a thousand times more annoying!" Happily, much of the print damage in evidence today can be prevented by good practice.

VOLUMES HAVE BEEN written on the subject of film damage, and yet defective prints continue to bedevil conscientious projectionists and destroy the real-as-life illusion the art of film strives to create. Even if we ignore the effects of excessive heat encountered in certain drive-ins, many vexing questions occur to us.

Why those bad splices that make a "pop" in the sound and give the picture a "jump" as they pass through the projection machine? Why those copious showers of "rain," or those deep scratches that weave like wave-tossed fishermen's lines between the players and the camera?

Who's to Blame?

Bad prints have been the bane of the projectionist's existence from the earliest nickelodeon days. At whom should the finger of blame be pointed? Well, it would be hypocritical to excuse the incompetent "operator" as long as highly skilled and experienced projectionists are available, or to fail to censure the penny-pinching distributor as long as the laboratories possess ample facilities for handling adequately large print orders.

But the lion's share of the blame should go, not to those very few projectionists or "exchange ladies" who do not quite measure up to the exacting requirements of their jobs, but to a rather large group of theatre owners and managers who refuse to modernize their obsolete projection equipment, and who even refuse to buy necessary replacement parts for the film-wrecking junk projectors they persist in retaining in their projection rooms.

As far as the film, itself, is concerned, today's projectionist is in a somewhat better position than his predecessors of the nitrate-film era. True, triacetate film is not quite so tough as high-quality nitrate film, but it shrinks somewhat less than nitrate during its useful life, and thus makes possible the use of projector sprockets of somewhat greater diameter.

The slightly larger intermittent sprockets in use today extend the perforation life of prints from more than 4 to about 17 times what it would be with the old small-diameter intermittent sprockets, according to Kodak tests. The reason: the larger sprockets fit more exactly the perforation pitch of the film.

The continued use of old 0.935-inch 16-tooth intermittent sprockets is therefore to be condemned in these days of low-shrink safety film and the newer 0.943- and 0.950-inch 16-tooth sprockets. (A sprocket 0.952 inch in diameter would mesh perfectly with unshrunken film having the standard perforation pitch of 0.187 inch. CinemaScope narrow-tooth sprockets exceed this root diameter by 0.001 inch.)

Although perforation damage (chipped edges of the sprocket holes and cracked corners) is not the most troublesome form of film damage at the present time, the projectionist must guard against causing it. How?

1. Avoid excessive gate tension.
2. Avoid excessive holdback tension on the upper-reel spindle.
3. Avoid excessive takeup-reel tension, which is apt to damage the edges of the perforations opposite the pull-down edges.

"Unblooped" Splices Noisy

The topic of bad film splices is another which may be dismissed with scant mention in this article except for one particularly annoying fault—annoying, that is, to movie patrons who dislike loud "pops," "clicks," and "thumps" in the sound. Fig. 1 illustrates the kind of splices to which we refer.

Four splice samples are shown in Fig. 1. Even if we assume that all four are solidly made joins which will last for the life of the print, only one of them is a truly satisfactory splice. Why? Three of them will make a "pop" or thumping noise in the speakers as they are scanned in the soundhead. As one projectionist aptly said, "The soundhead doesn't care what it reproduces!"

The upper-left splice labelled "excessively scraped" is a clear example of what we find all too often in the prints distributed by the film exchanges. A splice such as this may be strong, and accordingly embossed "O.K." by the

exchange inspectress. But it is a bad splice. The clear area across the soundtrack produces a boomy thump. (This defect can be corrected, without remaking the splice, by "blooping," as we shall explain anon.)

The lower-left splice labelled "underscraped" shows a join afflicted with a double thickness of emulsion along one edge. In addition to weakening the splice (cement **cannot** adhere to gelatine, but only to the acetate base), the somewhat darker area also produces a thump in the sound, albeit a much softer one than the clear area of the excessively scraped splice produces.

Although this splice may also be silenced by blooping, it should be remade in the interest of strength if the double-thickness area is too wide.

The upper-right splice illustrates a bad attempt at silencing a "noisy" splice by blooping it with an opaquing ink called "movietone lacquer." The "bloop" shown here is probably noisier than the undoctored splice. You just can't daub the black paint on the soundtrack any old way and expect good results! So let's look at a properly made bloop — the one shown in the lower right of Fig. 1. This splice (labeled "O.K. — well blooped") is the **only one** in this illustration which will pass through the soundhead without making a whisper in the speakers!

FIG. 1 — One good and three bad splices from the point of view of the optical sound reproducer. See text for explanation.

Good Blooping Practice

The theory of good soundtrack blooping is simple. If the "waves" appearing in a soundtrack are of a frequency lower than the sound system can reproduce, no sound will be heard. The best high-fidelity theatre sound systems can reproduce frequencies as low as 30 cycles per second, while less capable systems, or those having a purposely higher low-frequency cutoff, begin reproducing at about 50 cycles/second.

Now, a bloop pattern, if painted on the track with perfectly smooth edges, is a single "wave" whose frequency depends upon its length. A bloop one frame long, for example, represents one wave of sound having a frequency of 24 c/s.

It is interesting to note that the professional "printed-through" bloops made in soundtrack negatives are one frame (4 perforations) in length. These bloop images, which you will frequently find when inspecting your prints, are shaped either like elongated diamonds or elongated triangles.

Bloops are made in optical-sound negatives with a special punch which punches out a hole of the desired elongated pattern. The operator of the punch makes certain that the splice in the sound negative comes under the "thickest" part of the pattern. And so it is that the actual splices in sound negatives do not appear in the positive

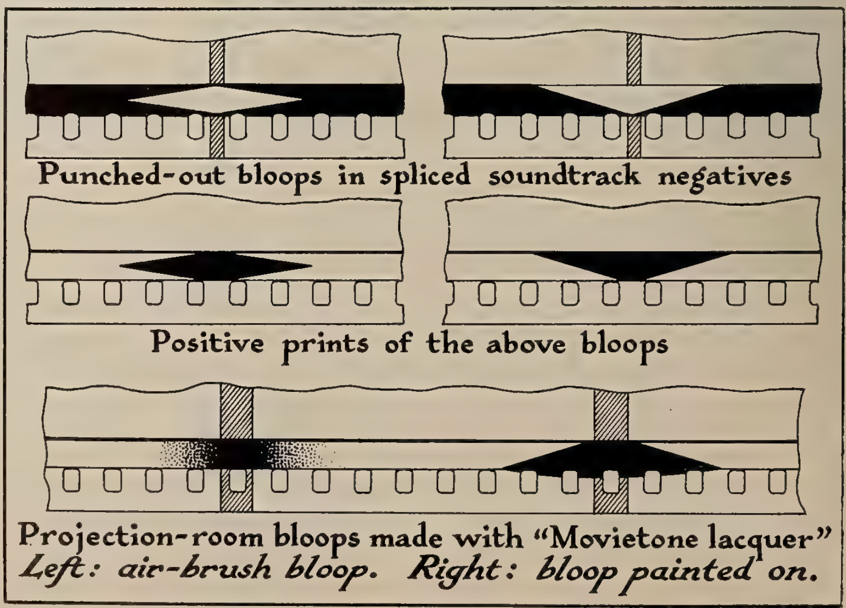


FIG. 2 — Professional punched bloops made in the studio cutting room contrasted with projection-room bloops applied to finished prints.

prints. (But the splices in the **picture negative** do print through, and can be seen in the **picture area** of release prints!)

Punched-out bloops in spliced sound negatives are shown in Fig. 2. Below them are drawings of the corresponding positive images in the prints. The sound-negative splices do not print across the picture portion of the positive because the picture area is masked off when the soundtrack is printed.

Projectionist-Made Bloops

Of greater practical importance to projectionists are the bloops in Fig. 2 which were made on finished prints with black movietone lacquer. The triangular bloop can be painted over a splice **on the base side of the film** with an acetone-base lacquer by means of a small camel's-hair brush. If a water-base ink is used, the bloop must be painted **on the emulsion side of the film.** (Water-base India ink is nevertheless not recommended because, when dry, it is liable to crack and chip off.)

Movietone lacquer is a solution of a suitable pigment or a dye so concentrated that no visible light or "near-infrared" radiation can pass through it to affect the photocell. The lacquer, or ink, merely "opaques" the area of the soundtrack to which it is applied. It can even be used to delete whole words from recorded dialogue, though release prints must never be tampered with in this way.

The air-brush type of "variable-density" bloop shown in Fig. 2, preferred by some exchanges for variable-area tracks, requires the use of a special applicator. The painted-on triangular type of bloop may be used on all kinds of optical tracks, and is the only type commended to the projectionist who has no blooping apparatus other than a bottle of movietone ink and a brush.

Special care should be taken to make the two sloping edges of the triangular bloop pattern **very smooth and gradual.** Sudden quirks in the bloop are noise-producing. It is also recommended that the base of the triangle be placed on the perforations to avoid messing up the picture area with the black fluid.

Although movietone lacquer may be purchased from large cinema-supply houses, it can be made by dissolving finely powdered carbon black (the kind used by artists for making their own India ink) in film cement to the consistency of syrup, and then thinning it for workability with acetone. This should be shaken before use, and must be opaque enough to conceal the track in one coat. The lacquer is applied to the base side of the film.

The art of rapid, neat blooping is

especially useful when making up reels of prevue trailers, permitting the projectionist to silence the large number of splices present in such composite reels.

On occasion we have warned against the presence of more than three feet of black film between the number "3" frame of the standard threading leader and the first frame of the actual picture. More than 3 feet of film (48 frames) in this part of a leader may result in a momentarily black screen when the changeover is made. Black screens, even if they last only for a fraction of a second, are noticed by the audience and are embarrassing to the projectionist.

The excess leader footage, which must be removed, is usually the result of leader replacement in subsequent-run prints by exchange inspectresses who apparently believe that if a little is good, more is better. Check your leaders carefully when inspecting a newly arrived shipment of films.

Another Print-Assembly Defect

A less common defect arising from careless print assembly, and one found on rare occasions even in prints of top-drawer productions, is the inclusion of a foot or so of sound "run-out" in the middle of 2000-ft. rolls of film. The "run-out" footage, which always adjoins the "mid-reel" splice, has a sound-leader print-through with various frameline and identification patterns in the soundtrack area.

A drawing of a sample of such film found in the middle of a 2000-ft. reel of a brand-new feature-film print is shown in Fig. 3. Can you imagine the indignation of an audience treated to this unexpected outburst of clattering noise during a dramatic scene in a premiere performance of a first-run picture?

Any projectionist who finds this kind of clutter in the soundtrack at the mid-reel splice (the point where the end of the "A" half of a 2000-ft. reel is spliced to the beginning of the "B" half) must excise the offending footage and re-splice the film. The splice should be blooped, of course.

And there are other items of "celluloid garbage" which should be removed from reels of release prints — license-seal footage which has framelines printed across the soundtrack area, for instance. Even though the law in a few states may require the presentation of such stuff on the screen, no law can force any theatre to play footage which is unsuitable and **absolutely cannot be run through the projectors.**

Film Scratches No. 1 Problem

The ubiquitous "scratch" problem is yet another, if not the chief, obstacle to good projection. All of us can agree that it's a shame how brand-new prints get ruined these days by one or two showings in theatres having magnetic reproducers mounted on the projector mechanisms in such a way that the film cannot avoid rubbing against rough metal.

We often see thousands of feet of relatively new color prints marred by deep lengthwise scratches, or by the multitudinous fine scratches that give the disconcerting effect of rain. The fire-valve rollers of the top and bottom film magazines are usually the source of the damage. This is proved by side-to-side weaving of the rain, indicating that, in some instances, the film was wound on a bent reel.

If the fire rollers jam and stop turning, the raised portions which contact the perforation margins of the film will wear down, permitting the picture and soundtrack areas to rub against the middle portion of the rollers.

Important General Precautions

Accumulated film dirt is usually the cause of fire-roller jamming, hence the necessity of keeping all parts of the fire-valve assemblies scrupulously clean. A single drop of light machine oil at each bearing is all the lubrication the fire rollers ever require.

The only real cure for "rain" is complete prevention by keeping the projectors clean and properly adjusted at all times. There is little or nothing that can be done to restore a print afflicted with scratches, particularly if the emulsion is deeply scratched. In some instances the film can be cleaned and lacquered, or otherwise treated (by patented or secret processes), to minimize the effect of the scratches. "Wet printing" is sometimes resorted to if the film is valuable, and the expense of making a copy can be borne by the owner.

Much film is scratched by improper rewinding. Lateral scratches caused by loose winding and slippage during shipment may cross the soundtrack and produce frying noises. Deep longitudinal scratches are sometimes scraped into the emulsion by the fingernails during inspection. Exchange inspect-

A great deal of film damage is caused by "cinching" loosely wound rolls of film, i.e., pulling down the free end of the roll. Loose rolls should be rewound under proper tension on a correctly aligned and adjusted rewinder. Bent reels should be discarded; and in this connection exchange managers might well consider that new, solidly made reels are far less expensive than replacement footage.

It always pays the projectionist to handle film gently for the benefit of the next projectionist to use it. Except when we receive brand-new "laboratory prints," we, ourselves, occupy the shoes of the "next projectionist."

IP

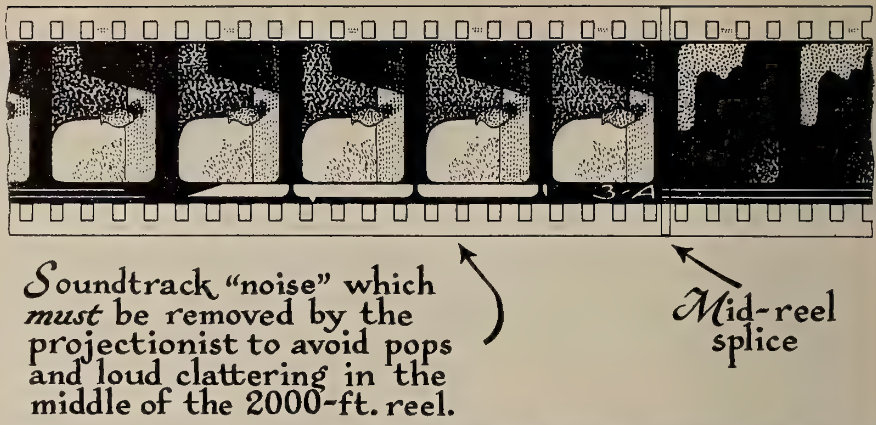


FIG. 3 — Soundtrack "noise" in the middle of a 2000-ft. reel resulting from inexpert print assembly. (A 2000-ft. "double reel" is usually made up by joining two 1000-ft. sections commonly called the "A" and "B" sections.)

Cinerama Inc. Buys Altec Speakers

As part of a major national expansion program, Cinerama, Inc. has purchased 650 Altec Lansing Voice of the Theatre speaker systems to be installed in 50 New Cinerama theaters, Altec President Alvis A. Ward reports.

Each theatre will house a set of 13 speaker systems consisting of Altec's basic A4 and A7 series. Total cost of the equipment is approximately $200,000.

To achieve the illusion of reality in Cinerama adventures, the high degree of technical perfection employed in film must be combined with specially engineered full fidelity sound systems. Ward said that Cinerama purchased the Altec units after conducting exhaustive tests on a variety of speakers.

Delivery of the Altec equipment is scheduled to begin in December.

So Business Is Poor? . . .

Morris I. Klapholz, editor of the Bulletin of the 25-30 Club (IATSE) and long-respected member of our beloved craft, presents his definitive answer to the question posed above.

DESPITE THE UPTURN in exhibition business all over the Nation, many exhibitors are voicing gripes aplenty because their own theatres have not yet shared in the new wave of prosperity. Yes, we cannot hide the fact that theatres are still folding and being converted into skating rinks, bowling alleys, and supermarkets.

The reasons? Brother, there are more than one!

Now, blaming it all on television won't help, although the theatres have undoubtedly lost patrons to TV that they may never recapture. But no one can deny that a vast public of potential moviegoers exists. It is squarely up to the entire industry to meet the conditions necessary to insure those gratifying long "queues" that stretch from the boxoffice window down to the next block.

A good story is the prime requirement for a good picture. And the picture need not necessarily be filmed in widescreen, CinemaScope, Todd-AO, or Cinerama—no, not even in color, though color is often desirable and helps to "sell" a picture. All the public really asks for is a good story at a reasonable admission price; and all else is merely frosting on the cake.

Second, halt the sale of feature films to TV! Hundreds of pictures have been sold to TV that could have been reissued for the entertainment of millions of the younger generation who just weren't around when those pictures were made. Many of the older films are classics—a stature seldom attained by present-day productions.

The reissue of the good oldies to the theatres at low rentals would, I believe, bring in to the coffers of the producing companies many millions of dollars **more** than has ever been realized from TV release. TV, the parasitic "grocery store of the airwaves," has reaped the advantage of what properly belongs **on the theatre screen!**

Here is a question for the entire industry: **Why** must a picture go before the cameras with an initial outlay of a million dollars and wind up "in the can" only after five million more have been spent? I've seen **better** pictures on TV "late shows" that had a budget of only $50,000 in their day—comparable to about $200,000 under present high-cost conditions.

A further question: What, in the name of all that is sacred, IS the matter with the theatre owner? Why does he sit back and do nothing while his projection equipment falls apart for lack of replacement units, and while producer-distributor groups gouge holy hell out of him for lack of reasonably priced pictures? Why doesn't he get into the game himself, and make the kinds of pictures he needs in order to stay in business? Studios and equipment are available! Competent writers, directors, actors, and technicians are likewise available. And we projectionists are still here, ready and waiting for up-to-date, high-quality projection and sound equipment with which to present the urgently needed new screen entertainment.

A good, dramatically intriguing feature picture—which **must** be built upon a good script (preferably an **original** one written expressly for the screen)—together with imaginative short-subject programming will, I am absolutely sure, place the motion-picture theatre on the stairway to the stars economically and entertainment-wise.

MORRIS I. KLAPHOLZ

(To which IP adds a fervent "Amen—so be it!" ED.)

iP

NEW THEATRE

Harry Mace has installed a 50-foot screen and the latest North American Philips-Norelco 70mm projector in his new de luxe 887-seat Kachina Theatre at Scotsdale, Ariz.

The construction of the Kachina was rushed for the November premiere of "Butterfield 8" (M-G-M) which stars Elizabeth Taylor, Laurence Harvey, Eddie Fisher and Dina Merrill.

LETTERS TO THE EDITOR

"For Advice on Lens Adapters, Query Equipment Dealers"

EDITOR, IP:

An expected change from Motiograph K to Motiograph AA heads in my theatre brings up the problems of adapting our old lenses to the new machines. The present setup is as follows:

Model K heads, Wollensak f/1.9 3″ lenses with 1:1.85 apertures, throw to screen is 90 feet, and screen size 13′ 5″ x 30′. (I am losing about 18 inches on each side of the picture, which is as it should be.) CinemaScope picture projected with Kollmorgen Series II BX-163 4.50-inch lenses for a 13′ x 30′ picture with 1:2.00 aperture and Super Panatars by Panavision.

Now, what apertures, lenses, and Panatar adapters must I have to obtain these same picture sizes with the Motiograph AA heads? I have a set of Bausch & Lomb f/2.0 4.50-inch lenses that fit the AA heads. Could I use these in place of the Kollmorgen lenses for CinemaScope? The Wollensak and Kollmorgen lenses don't fit the lens-holders of the AA's, as they are too small in diameter. Are there adapters for these? To fit the Panatar adapters to the AA heads, will it be necessary to drill holes? Is there a template for this?

There is no problem in switching the heads, as they are both on Motiograph SH-7500 soundheads.

J. H. NEIMOYER
IATSE Local 672
Yreka, California

EDITOR'S REPLY:

Equipment problems such as the ones posed in Brother Neimoyer's letter are so specialized that no blanket advice can be given to cover all cases. The manufacturers of the projectors and lenses involved believe that the equipment dealer should furnish the necessary lens adapters.

Motiograph reports as follows: "Recently manufactured Motiograph AA and AAA projectors have a 4-inch diameter lens holder. We furnish an adapter to hold lenses of all makes having the 2-25/32-inch diameter barrel, and this may be obtained from our dealer, the B. F. Shearer Company, P.O. Box 848, San Francisco, California. This dealer also supplies Panatar lenses, and can furnish information on adapting them for our AA and AAA mechanisms."

Bausch & Lomb says: "You asked if your Bausch & Lomb 4.50″ EF Cinephor lenses can be used with the Panavision anamorphic attachment. According to the literature we have, the Panavision Super Panatar 100 is designed for use with lenses having a 2-25/32″ barrel diameter, while the Panatar Super 400 is designed for use with 4″ diameter objective lenses.

"Assuming that you have the Super 100, there should be no reason why you could not use Bausch & Lomb prime lenses. I am enclosing a list of our adapters for Cinephor lenses. Since you say that our lenses fit your AA head, you no doubt have these already."

And from Kollmorgen: "We are sending along our Bulletin No. 222, which contains all the information we have relative to adapter requirements for various projectors. You will note from the enclosed literature that the only adapter for Motiograph projectors that will serve the purpose you have in mind is the AX-155. However, we think you already have this because it is usually required for use with the Model K, the head you are currently using.

"We suggest that you contact the dealer from whom you purchased the Kollmorgen lenses. He is best qualified to help solve this particular problem, and also to supply the necessary parts."

EDITOR, IP:

I should like to know if you offer a book on the replacement of projector parts. I have the **Manual of Practical Projection** by Robert A. Mitchell, and now I need a book on how to remove and replace projector parts.

GUSTAVO HERNANDEZ.
Carrizo Springs, Texas

EDITOR'S REPLY:

There is no single book which covers the maintenance, servicing, and repair of all the different makes and models of projector mechanisms, soundheads, arc-lamps, rectifiers, amplifiers, etc. We suggest that you write to the manufacturer of your projectors requesting a copy of his operating and maintenance manual for the particular model of projector you are operating on, specifying the serial numbers if possible.

A projectionist-friend who has had experience on the make and model of mechanisms you have, or your sound-service engineer, will probably be glad to assist you with difficult servicing problems. At all events, a projectionist

should be sure of himself and know exactly what he is doing before attempting to "knock down" a projector mechanism or to replace and adjust its parts.

Consistent Placement of Reels Saves Time and Extra Work

EDITOR, IP:

Many projectionists make it a habit to place the reels in the film cabinet a certain way after they come off the rewind. Here is what I mean:

Let's say we have a motor rewind mounted on top of a combination Neumade film-storage cabinet and bench which is directly behind the projectors. The reel is pulled off the rewind turned 180 degrees clockwise and dropped into the film cabinet with the right hand. This puts the reel in the film cabinet correctly for a left- or right-handed person to take it out later. Either hand can lift the reel out, and it will not be necessary to turn the reel around when he goes to put it in the machine. Of course, this does not apply when the film cabinet is placed on the front wall. In that case, the procedure should be just the reverse.

Sometimes it seems more convenient for projectionists to turn the reel 180° counter-clockwise after it was pulled off the rewind and drop it into the film cabinet with the left hand, just as a left-handed person would be more apt to do. This would place the reel in the film cabinet (which in this case is located to the rear of the projectors) differently so that the reel would have to be turned around one way or the other before putting the reel in the projector magazine.

It usually happens that if a fellow isn't particular how he places the reels in the storage cabinet, the way the reels will come out depends on whether he is left- or right-handed, and which hand was used to drop the reel into the cabinet.

WILLIAM PALUMBO
Niagara Falls, New York

EDITOR, IP:

I'd appreciate it very much if you would publish the circuit diagram of the changeover switch used for controlling the exciter lamps in a double-projector system from points remote from the machine which is operating.

G. RAMADHURAI
Pudukkottai
Madras State, India

EDITOR'S REPLY:

The actual circuit of a 2-projector exciter-lamp system is very simple. As a rule, a single-pole-double-throw switch is employed; and this is sometimes operated by remote-control relay buttons placed on the front wall of the projection room at the right of each projector. A mere press of either button throws the switch to one contact or the other, as shown in the top panel of the accompanying diagram. The relay circuit is not shown.

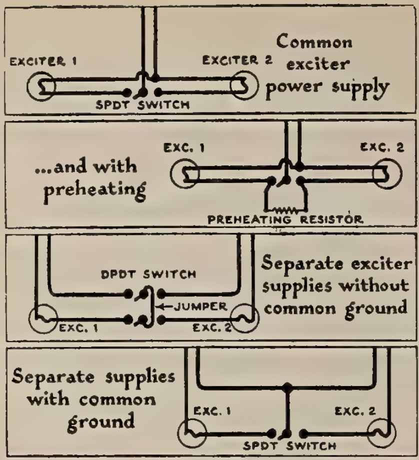
Another method is to place the SPDT switch at the front of one of the projectors, and a dummy, or slave, switch mechanically linked to it by means of a rod at the front of the other projector. Thus the switch may be worked from either position.

A new system which is coming into favor in many parts of the world involves a simple on-off switch for the exciter on each projector. This is mechanically coupled to the picture-changeover shutter of each machine, so that when the picture is changed over from one machine to the other, the exciter of the outgoing machine automatically goes off, and that of the incoming projector automatically goes on. This is a very sensible system, and it makes the projectionist's work easier.

The purpose of the preheating resistor shown in the second panel of the drawing is to keep the filament of the non-operating exciter at a dull red heat in order to prevent "thermal lag" and make the sound changeover instantan-

eous. This feature is not really necessary, however; and there is a risk, if the preheating voltage is too high, of making "threading noises" audible in the sound system — the noise of film being threaded through the soundhead of the idle projector.

The third and fourth panels of the diagram show hookups which are not much used, but which are customary when there is a separate current-source



for each exciter. The fourth circuit, utilizing a common ground wire for the two sources, is preferable, and it permits the use of a single-pole-double-throw switch, either hand- or relay-controlled.

Relay circuits are supplied by the manufacturers of such equipment.

Mechau Pro's and Con's

Editor, IP:

I found the article on non-intermittent projectors by IA Brother J. G. Jackson in the May issue of IP both interesting and instructive, but I hasten to point out that the Mechau had 2nd-surface, **not** 1st-surface, mirrors, as everyone seems to believe. Having cleaned these mirrors as a maintenance routine when I was operating on Mechaus in Europe, I often wondered why they were not of the 1st-surface type.

There was no secondary image on the screen with the Mechau, so I guess it was lost in the projection process. The main difference between Jackson's non-intermittent projector and the Mechau is that the Mechau **dissolves** each frame into the succeeding one, whereas Jackson's **"wipes"** from each frame to the next. Also, it appears to me that Jackson's machine might possibly be restricted as to the range of lenses it could use, whereas the Mechau did not have this problem.

RICHARD O. BARTEL
IATSE Local 162
San Francisco, California

Editor's note:—As most of IP's readers will recall, Dick Bartel contributed the interesting "first-person" story on Mechau operation in the December 1959 issue (p. 12). J. G. Jackson, well-known projection technologist and builder of the new non-intermittent projector described in the informative article he contributed to the May issue (p. 5 et seq.), replies as follows:

Editor, IP:

Thanks to Brother Richard Bartel for his information and comments on non-intermittent projectors. I was not aware that the Mechau used 2nd-surface mirrors, but there is no reason why they could not be used with equal success in my mechanism. However, the surface on which the mirrors are silvered is a minor detail, and does not alter the optical principles of the projectors.

Brother Bartel also seems to think that mine would be restricted as to the use of lenses of various focal lengths. This impression is incorrect. There are two ways to overcome his objection.

1. First, it is only necessary to change one small stationary cam which controls the tilt of the mirrors during projection. This cam will be accurately set on dowel pins with only one thumbscrew, and can be changed more easily than changing a lens.

In modern projection we change lenses, apertures, film gates, idlers, and sprockets, so there should be no objection to changing one small cam as well to suit the focal length of a lens or the projection distance.

As I have not had any experience on the Mechau projector I will not dispute Brother Bartel's statement that the Mechau does not require a change of cams when changing lenses of different focal lengths or the projection distance. In my own mind, however, I am inclined to suspect that a change of cam curvature would be required if the difference in focal length were substantial, or if the projection distance was changed considerably.

Since the two mirrors reflecting the image to the screen must be so controlled as to superimpose the images on the screen, and the superposition is dependent on the curvature of the cams, then it is reasonable to suppose that the cam or cams must be designed to suit the conditions of lens E.F. and projection distance which prevail at any given time. I am willing to stand corrected on this if and when further information pertainin gto the Mechau can be obtained from other craftsman who have had actual experience on the machine.

2. The second way to overcome any possible difficulty with lenses of excessively short focal length would be to use lensese of the "inverted Gali-

lean" type of optical construction. These are represented commercially by the Kollmorgen X-tended lenses and the new Visual Image Compensators which effectively halve the focal lengths of regular lenses without materially altering the distance between the film and the rear element. Although no definite proof is available at this time that these newer lenses would be practical in non-intermittent projectors, additional information will doubtless be forthcoming.

J. G. JACKSON
Port Alberni, B.C.

Editor, IP:

I have read with interest two recent articles on non-intermittent projectors, namely, the item appearing in the August 1959 issue of IP (p. 15) with comment thereon by Don Kloepfel of General Film Laboratories, Hollywood, and the article by J. G. Jackson in the May 1960 issue (p. 5 et seq.) in which the author discusses both the German Mechau projector and his own method of accomplishing non-intermittent projection with continuous film travel.

Some thirty years ago the writer, who has been in the theatre-equipment business for 42 years, supplied a small quantity of projector parts to the owner of a very modern machine shop, Charles Taylor, in Toronto. Mr. Taylor accomplished non-intermittent projection purely for the satisfaction of having successfully solved the problem. He constructed a working unit, put it into operation, and persuaded the writer to observe its performance. The film traveled at a constant speed, and the projected image was satisfactory in every respect. Mr. Taylor's son informed me a few years ago that this unit is still in existence.

Briefly, the light from a 500-watt T-20 Mazda lamp was directed **down** through the film, which traveled without variation in speed under light tension. The "aperture" was of normal width, but two frames high. The beam then passed down through any suitable objective lens, and was reflected by an oscillating mirror at an angle of approximately 45° to the vertical. The beam passed to the screen horizontally after reflection from the mirror.

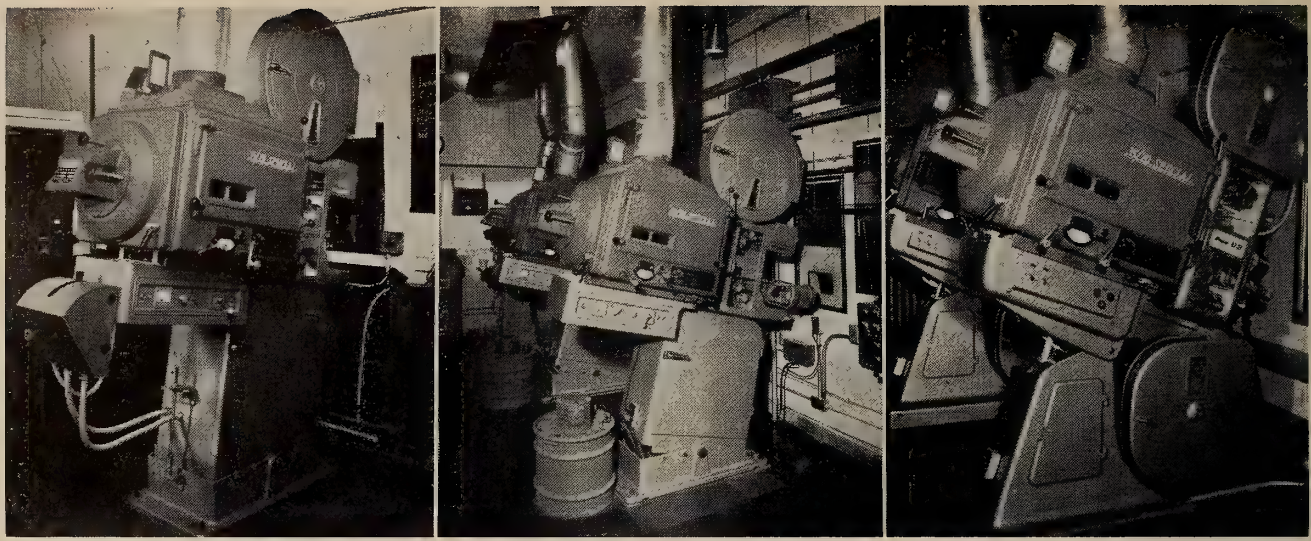
The mirror was oscillated, or "timed," by means of a roller following one turn of a machined came made of steel about three inches in diameter, one turn of the cam being timed to provide the necessary optical rectification.

The mirror maintained motionless on the screen the image of one frame during roughly 95 per cent of its passage across the aperture. The "recovery" to transmit the light from the succeeding frame took about 5 per cent of the movement of the roller and cam—the roller dropping rather quickly to the start postion on the cam.

The design of this machine can be modified to suit any circumstances, the mirror under light tension delivers a very steady image, and the unit is virtually noiseless. The unit observed by the writer was driven by a small motor. The only design objection might be an aperture two frames in length, but from my personal observation the picture quality possible without extreme concentration of the "spot" completely compensates for the small loss of light involved. Light sources need not be as powerful as those commonly in use, inasmuch as there is no revolving shutter to waste more than half the light.

The writer brought this non-intermittent projector to the attention of one of our prominent projector manufacturers a number of years ago. He examined the unit here in Toronto and termed it a fully successful "light-beam movement." But when it came to considering so simple and compact a unit for commercial production, the idea was shelved. Adoption

(Continued on Page 16)



35/70 INSTALLATIONS—Shown are installations of Strong "35/70 Special" projection arc lamps. (Left to right: 35/70's on Victorias, Lincoln Theatre, Miami, Fla.; 35/70's on Victoria X's, Uptown Theatre, Calgary, Alberta, Canada; and 35/70's on Bauers at the Center Theatre, Fall River, Mass.).

Cinerama Develops Transistorized Sound

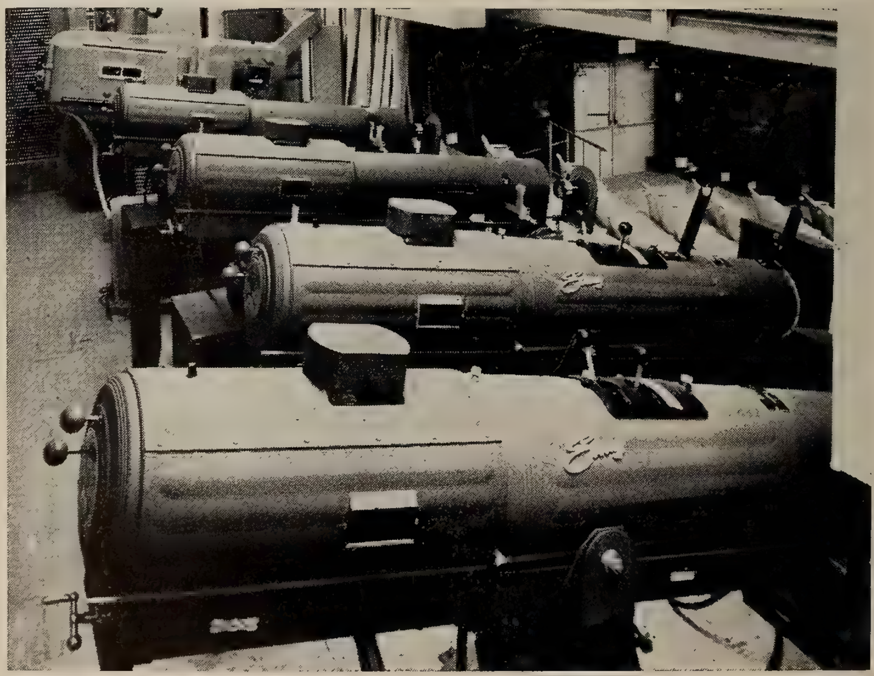
NEW YORK—Cinerama, Inc. has developed a completely transistorized sound system which provides a savings in terms of space and weight over all previous, bulkier sound systems.

The transistorized units were developed to Cinerama's requirements by Dr. D. G. C. Hare, head of the Grass Valley Group of California. The sound system entirely eliminates vacuum tubes and transformers.

The system accomplishes three main objectives: The savings in space and weight will mean lower transportation costs to Cinerama installations both here and abroad; It reduces to a bare minimum the amount of power loss as compared with that ordinarily dissipated in heat by vacuum tubes, while at the same time reducing maintenance and increasing reliability, and the audio quality is vastly improved over previous systems, the new equipment using no transformers and being capable of handling high peak power levels without the usual overhead characteristics.

The development, exclusively for Cinerama use, means that theatre installation costs for the giant screen process will be reduced materially and the new installations will be far superior in terms of maintenance and reliability.

The heart of the system, is the all-transistor power amplifier, which will deliver the same total audio power to the theatre speakers as was previously realized from the vacuum tube amplifiers. The new unit is one-fifth the size and weight of the previous unit. The clarity of sound definition produced with the new process is said to be remarkable, the separation of various sources of sound is highly accented, intermodulation distortion is down considerably and the ability to reproduce transients without distortion is much better than in previous efforts.



BOOTH—One of the most complete and modern projection booths of any industrial company auditorium is that of the General Electric Company, Louisville, Kentucky. Equipment for large screen projection of motion pictures and all types and sizes of slides, as well as follow spotlights for providing brilliant lighting on all live presentations and activities on the stage, are made possible by the installation of five separate equipments of the most modern type. All five of the projectors utilize carbon arcs as a light source. An exclusive lens system which eliminates all waste of light results in spotlights which are extremely white and bright. The light source in the slide projectors is so intense that large brilliant pictures can be projected even without completely darkening the auditorium, when it is desirable to maintain illumination as for taking notes during sales talks and lectures. Such presentation of slides is often also desirable for technical conferences, conventions and training schools.

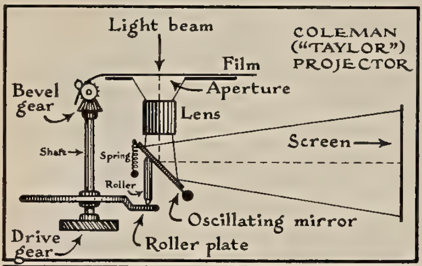
LETTERS

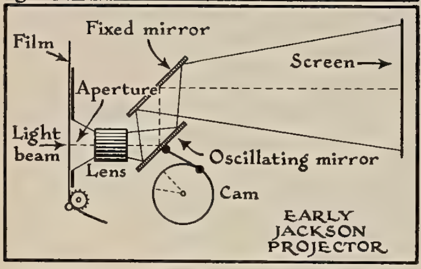
. . . Continued from Page 13

of the Taylor unit would require a retooling of the factories and discontinuance of conventional set-ups.

The writer submitted a description similar to this to Mr. Kloepfel in 1959 and received a reply requesting a rough sketch or drawing from which design could proceed. Due to the pressure of other matters we could not find the time to comply with this request, but if Mr. Kloepfel or other responsible party desires a sketch now, we shall be glad to prepare one.

J. HARRY COLEMAN
The Coleman Electric Co.
Toronto, Ontario.





Editor's note:—A diagram of the Taylor projector as compared with the one built by J. G. Jackson, based upon sketches kindly supplied by Mr. Jackson, is given herewith. Also appended are J. G. Jackson's opinions anent the Taylor mechanism.

Editor, IP:

Mr. Coleman's description of the Taylor projector is particularly interesting to me, as I also did some experimenting on the very same type of projector. In fact, it was my first experiment with non-intermittent projectors back in 1939. I used a Motiograph Model 1A projector (1912) — the little hand-cranked unit—which I still have in my shop, though having used some of the gears from it in my other projectors, it is no longer complete.

I geared the intermittent sprocket to revolve continuously and actuate a cam to tilt the mirror. While Mr. Taylor set his model horizontally so as to use only one oscillating mirror, I set mine upright and used two mirrors, one of them fixed, to put the image on the screen.

I soon discarded this type of projector for several reasons, the main one being the low luminous efficiency of the 2-frame aperture. Even with a fast return of the mirror, I found that I got less light on the screen than I did with the intermittent projector. The spot required for a 2-frame aperture has **more than twice the area** of one for a single frame, hence the luminous flux passing through a film frame is less than half what it would be in a normal single-frame projector.

Mr. Coleman also states that no shutter is required in the Taylor machine. This may have been true with a 500-watt mazda lamp; but I doubt very much that the absence of a shutter would be permissable if a high-powered arc were used to provide a high screen brilliancy. I am afraid that travel ghost would show up no matter how fast the mirror returned to its starting position. And, of course, if a shutter were used, the luminous efficiency of the machine would be reduced just that much more. Then, too, I found that light from the unused frame in the aperture flashed to the screen, hitting both above and below the screen.

I soon found out that many other inventors had tried out this same idea before, so I abandoned it and searched for a system of my own — an eminently feasible system which the overwhelming majority of responsible projection experts agree is superior to other systems of non-intermittent projection which have been tried out up to the present time.

Thanks to IP, the projectionist's own magazine, everyone interested in the art, including projectionists, inventors, and manufacturers, have at their disposal an ideal medium for the expression of their views on all projection topics. Let's hear from others who have done experimental work in the field of projector design. How about it?

J. G. JACKSON
Port Alberni, B. C.

Questions & Answers

From Frank W. Mango, IATSE Local 150, Los Angeles, California come the following interesting queries which cannot be answered in all cases as fully as we might wish, but nevertheless serve to indicate the nature of the technical problems occupying the attention of advanced projectionists.

Q. Referring to the various optical sound reproducers which have appeared since 1927: are there accurate data available which give honest values of wow and flutter in gate-type heads as compared with the more common fluid rotary-stabilizer types?

A. No studies of which we are aware have been made to give these comparisons. However, modern standards are rather definite in regard to sound-on film recorders: if the rate of film travel does not vary from 90 feet per minute by more than 0.05% either way—a total flutter content of 0.1%,— the amount of flutter is considered to be satisfactorily low. Modern theatre reproducers of the rotary stabilizer type are designed for a flutter content under 0.2%, but improper operation can greatly increase the amount of flutter obtained with these heads. However, old gate-type heads often had a flutter content as high as 1% even when in good working condition. Much of this could be attributed to the 96-cycle disturbance caused by the film perforations and teeth of the sound sprocket.

Q. What is responsible for the annoying wow and flutter so often heard in 16-mm reproduction? Will you go into detail on various designs of 16-mm optical scanning stabilizer assembly principles? Also, is the flutter sometimes already in the print as a result of accumulation from original recording to final print by way of dupes, etc.?

A. Most of the flutter originating in 16-mm projectors is due to (1) inadequate size of the sound flywheel, (2) use of a solid flywheel which, unlike a good rotary stabilizer, returns disturbing forces to the film in the form of low-frequency "wows," and (3) dirt, improper lubrication and other defects of the pressure rollers used in some projectors to insure contact of the film with the scanning drum.

Details of the construction of the sound transport mechanisms of the dozens of different makes and models are best obtained from the manufacturers.

Flutter is nearly always introduced into 16-mm prints from 35-mm originals by the re-recording process, although with good equipment this should never exceed a total of 0.2%. This small amount of flutter is easily **measurable with** a flutter bridge, but it is doubtful that the ear could detect it even in tones exceeding 5000 or 6000 cycles.

Q. In preview rooms where the projection throw does not generally exceed 60 feet and sheet width is under 30 feet, and where flicker is made more obvious by too much screen light, what were the economic or technical reasons for changing over to the Suprex type of light source?

A. The use of low-amperage Suprex ("simplifed high-intensity") arcs in preview rooms instead of Mazda or low-intensity arcs is dictated by (1) economy of operation and (2) daylight-white quality of illumination suitable for judging the balance of color films.

The 7- and 6-mm Suprex trim of carbons may be burned at 40 amperes with an arc drop of 27½ volts to give 6500 screen lumens with a mirror 11⅜ inches in diameter. This is only 1100

watts, about half the power required by a small low-intensity arc, which is hotter, yellower, and dimmer. The same Suprex trim burns at 42 amps., 36 volts (1500 watts) to give 8600 screen lumens with a 14-inch diameter — more light than a 35-amp L.I. arc at less power consumption. H.I. arcs provide enough light for flickerless 3-blade shutters to be used with 5-to-1 intermittent movements in preview rooms.

Mazda incandescent bulbs are clean and convenient, but are unsuitable for the projection of color films. The new tenon lamps, not yet manufactured in the U.S., appear promising for this purpose.

Q. Cost not considered, what are the processes and precautions one could take to insure an absolute minimum of vertical jump in projected pictures, not limiting your recommendations to the geneva movement alone, and excluding an off-standard type of film?

A. Use of a high-grade geneva movement is, of course, absolutely necessary for rocksteady pictures — no vertical "jumping" of the picture. But even when such an intermittent is used, the intermittent sprocket must be positioned as close to the gate aperture as possible (to minimize the effects of uneven film shrinkage), the gate film trap should be as long as possible, adequate uniform tension should be applied to the film in the gate by the pressure pads, and the upper and lower film loops should not be so large that they "flop" and tend to disturb the film in the gate. The sprocket teeth must be accurately ground and unworn, and the sprocket must be fastened to the starwheel shaft by a method that does not allow it to run "lop-sided." A lop-sided sprocket produces 6-cycle vertical "dancing" of the picture.

iP

Kodak Scientists Prepare New Photo Textbook Edition

A new edition of a standard reference work and textbook, "Fundamentals of Photographic Theory," has been prepared by Dr. T. Howard James and Dr. George C. Higgins of Kodak Research Laboratories in Rochester, N.Y.

Rapid advances in such fields as the theory of color photography and sensitometry necessitated revision of the text and the addition of 66 pages to the book. It was first published in 1948.

The authors added extensively to chapters on the mechanism of development, the structure of the developed image, and the theory of the formation of the latent image. New criteria for evaluating photographic systems are included.

The new edition, published by Morgan and Morgan Inc., New York, covers what happens to film from the instant of exposure through development, fixing, washing, and print making. The authors also describe the chemistry of the formation of dye images for color photography.

Dr. James, a senior research associate, has been with Kodak Research Laboratories since 1936. He is the editor of "Photographic Science and Engineering," section editor of "Chemical Abstracts," and a lecturer in photographic theory at the Rochester Institute of Technology.

Dr. Higgins formerly taught at Billings Polytechnic Institute, Billings, Montana, and the University of Wyoming. He joined Kodak Research Laboratories in 1943 and is now associate head of the physics division.

iP

HARRISON SERVICES

ST. PAUL, MINN. — Funeral services for George Irving Harrison, 63, of 117 Eighth St., White Bear Lake were held here.

Mr. Harrison, a motion picture projectionist, had lived in White Bear Lake for the last twenty years. He was projectionist for the St. Clair Theatre for four years. He was a member of Garnet lodge No. 166, A.F. and A.M., White Bear Lake, and the Motion Picture Operators union of St. Paul.

Survivors include his wife, Amy, White Bear Lake; a son, Robert, Minneapolis; a brother, Kenneth, Stillwater, and two grandchildren.

iP

MONTHLY CHAT

. . . Continued from Page 3

And that is exactly what is wrong with the motion-picture industry today — bad management resulting from a short-sighted view of things and a lack of confidence which unmistakably reveals timidity and incompetence on the part of too many studio and theatre executives. Let it not be forgotten that the movies were created and nurtured by vitality, vision, and a pioneering, adventurous spirit which scoffed at temporary hardship and sacrifice!

After the Christmas season comes the new year — a year of fateful decision and tremendous responsibility. Is the present wave of prosperity to be arrested by exhibitors who mistakenly gauge successful theatre operation by pennies pared from essential booth costs, or by producers who imagine they are "playing it safe" by directing their camera lenses into the deadly gray smog of routine TV production? We sincerely hope not. Theatre motion pictures, born of youth and ever-young, deserve more faith, more effort, greater sacrifice. It needs men of imagination supported by men of backbone. Such men, thank God, are among us, working for us and with us.

IP wishes a happy and peaceful Christmas to all, with special good wishes directed to members of the projection fraternity. May your arcs burn brighter for the entertainment of even larger audiences during the new year!

iP

British Theatre Automation Shown at German Photokina

COLOGNE, GERMANY — New development in automation and remote control for the theatre was demonstrated at the Photokina Exposition in Cologne by the G. B-Kalee Division of Rank Precision Industries Ltd.

An electric timer device for automatic changeover of projectors and the latest remote control panel were both shown for the first time. The complete exhibit was shown in Hall 9, Stand 9001/9101, which is being shared with Messrs. Cinemeccanica Soc.p.Az.

Two Victoria X projectors were shown, fitted with a new electric timer device for automatic changeovers. One machine was equipped for a wide screen aspect ratio, while the other was set up for the standard picture. The "auditorium" was lit with white flood lights in simulation of normal house lighting; coloured spot lights represented the stage lights. A Harkness Perlux screen was mounted in a working model frame, complete with motor driven masking and curtains.

The actual changeovers, triggered by a mark on the film, were handled by the electric timer. All the external functions, such as the control of dimmers, masking and curtains were taken care of by the drum model Projectomatic.

The new Gaumont-Kalee compact Remote Control Panel affords complete manual control of the presentation. Normally installed in the auditorium, it was, for exhibition purposes, set up behind the projectors so that the remote control of the equipment could be directly observed by visitors to the stand.

With this panel it is possible to start and stop the show and to control all the external functions, at the same time monitoring the sequence of operations of the automatic changeover device by means of the various indicator lamps provided. In a regular installation a telephone handset is provided so that the operator may speak to the projection room by means of a loudspeaker or, alternatively, it may be switched into the theatre's house telephone system. The panel, in fact, incorporates high-reliability miniature components, but for this exhibition it was mounted in a fairly large desk.

iP

U.S. Exports of Film And Equipment

WASHINGTON — United States exports of motion picture film and equipment during the first nine months of 1960 amounted to $34,949,305, a 9.6 % increase over the corresponding exports for 1959 valued at $31,875,389, according to preliminary figures announced by Scientific, Motion Picture and Photographic Products Division, Business and Defense Services Administration, Department of Commerce.

Foreign shipments of motion picture film (raw stock) in the first three quarters of 1960 amounted to 513,586,912 linear feet valued at $15,063,690 compared with 527,964,693 linear feet valued at $13,210,463 for the same period of 1959. A 62 percent increase in the value of exports of 35-mm. negative films more than offset lower exports of 16-mm. and 35-mm. positive rawstock film. There was a decided drop in the quantity and value of exposed 16 mm. and 35 mm. motion picture feature film exported during the period under discussion.

Total exports of all types of motion picture equipment including cameras, studio, projection and sound equipment during the first nine months of 1960 amounted to $12,102,235, nearly 15% higher than the corresponding shipments for 1959 valued at $10,545,048. The gain was due in part to the 36.7 percent increase in motion picture studio equipment.

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